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INVENTOR(S)

Given Name (first and middle [if any])	Family Name or Surname	Residence (City and either State or Foreign Country)
Harold E.	Zell	Saint Simons Island, GA
Larry	Parks	Shelby Twp., MI
Larry	Robinson	Houston, TX
Bill	McCormick	Starke, FL

☐ *Additional inventors are being named on the ___ separately numbered sheets attached hereto.*

TITLE OF THE INVENTION (500 characters max)

Efficient Container Systems and Methods for Packaging and Display

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Respectfully submitted,

SIGNATURE *Glenn P. Ladwig*

Date: June 10, 2003

TYPED or PRINTED NAME Glenn P. Ladwig

REGISTRATION NO. *(if appropriate)*: 46,853

TELEPHONE (352) 375-8100

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Provisional Patent Application
Docket No. ZLL-100P

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Docket No. : ZLL-100P

Applicants : Harold E. Zell, Larry Parks, Larry Robinson, Bill McCormick

For : Efficient Container Systems and Methods for Packaging and Display

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P.O. Box 1450
Alexandria, VA 22313-1450

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DESCRIPTION

EFFICIENT CONTAINER SYSTEMS AND METHODS FOR PACKAGING AND DISPLAY

Background of Invention

The present invention relates generally to merchandise packaging and, more particularly, to containers and closures for packaging various types of products, including food and beverage products, in a space efficient manner.

In the manufacture of containers designed for marketing of household articles, such as cleaning products, food products, and other commodities, such containers are conventionally made in such a manner that it is difficult to stack them vertically one upon another and maintain them in stacked arrangement. For example, in the case of metal or plastic cans, these containers are generally made with flat end walls, usually flanged around the edge and of the same diameter from one end to another. Therefore, when such containers are placed vertically one upon another, there is only a narrow edge-to-edge contact between the flange at the top end of a can and the flange at the bottom end of the superiorly positioned can. As a result, such cans can be easily knocked out of position and can ultimately result in the collapse of the entire stack of cans. The slipping or falling of cans from a stacked arrangement can result in great inconvenience, labor cost, and even risk of injury to people in proximity to the stacked cans. Furthermore, cans can be damaged as a result of falling due to ineffective stacking thus leading to loss of inventory and economic loss to the merchant. Furthermore, if the of the can included a potentially hazardous material, such as drain cleaner, a health hazard would result if the can were be broken and its contents displaced.

Exemplified U.S. patents pertaining to stackable containers include U.S. Patent Nos. 3,001,564; 3,065,558; 3,091,361; 3,207,359; 3,217,915; 3,587,904; 3,598,271; 3,642,789; 3,642,169; and 4,485,923. In most of the aforesaid patents, the uppermost container would have virtually no resistance to falling in the event the stack is bumped or shaken. Furthermore, many

of the stacking systems disclosed in the aforementioned patents do not employ the container closure as part of the stacking mechanism. In some instances, where the container closure is utilized in a stacking function, the closure itself may have to bear all or most of the weight of the containers above it.

Adaptors for adhering a plurality of cans together in selected configurations are described in U.S. Patent Nos. 5,297,681; 4,593,818; 4,502,447; 4,415,077; 4,377,231; and 3,624,789. Can stackers are often utilized where cans are assembled end-to-end with back-to-back/top-to-bottom/top-to-top/bottom-to-bottom adapters performing the adhering or securing of the cans to form a unitary physically secure unit (for example, a pallet unit). Thus, in general, the adaptors engage the opposing rims of cylindrical cans and hold them solidly one upon the other. Ring-type can stackers, such as those described in U.S. Patent No. 4,593,818, have various tab-like side pieces projecting inwardly from the ring and perform a gripping action on the engaging can. These devices can be composed of flexible sheet metal or elastic memory-containing material, such as rubber or plastic.

In the packaging of food products, as well as other merchandise, it is desirable to provide containers that can be easily and economically produced in desired quantities and which are usable and effective to enclose various types of contents.

Existing containers have failed to meet one or more of the aforementioned objectives, exhibiting various shortcomings. For example, some container devices provide ease in opening but are incapable of being reliably resealed after the initial opening.

Many containers have a substantially circular cross-section, providing a cylindrical shape, in order to facilitate rolling operations that may be desirable in connection with capping and/or labeling operations normally carried out after the contents have been placed in an open container. However, the cylindrical shape has several practical disadvantages. Cylindrical containers are not space efficient. There is a significant amount of void space between individual containers when such containers are shipped, displayed, or otherwise placed side-by-side. This void space can be significantly reduced by the use of a container with a square-shaped or rectangle-shaped cross-section. In addition, such containers are easier to grip than cylindrical containers. Rectangle-shaped containers with roughly square-shaped cross-sections are disclosed in U.S.

Patent Nos. 4,895,298 and 5,377,858. Cylindrical containers also typically require the use of a packaging case for one or more of the containers in order to stack the containers for storage or shipment.

Several types of "press-on" or "snap-on" container closures are presently used for the packaging of products. A common feature of these types of container closures is that the cap and the container neck have engaging cams, ribs, or threads that allow the cap to be "snapped" or "pressed" onto the container to a closed position over an opening in the top of the container.

The removal of the cap in "press-on" or "snap-on" container systems can occur in a variety of ways. A common way to remove a cap of this construction is to push or pull a grooved cap back off of the engaging rim of a container. This cap structure and means of removal are commonly employed in the construction of container closures for aspirin bottles. Another means for removing the cap involves pushing on the sides of the cap to deform the shape of the cap slightly so that ribs or cams on the cap disengage from those on the container, thus releasing the cap from the container. Another means employed for removing the cap involves twisting the cap about a vertical axis with respect to the container to release engaged ribs or threads. Generally, these twist-off systems require the user to push the cap downward while twisting to disengage the threads or ribs on the cap from those on the container. In container systems that do not require the cap to be pushed downward during the twisting motion, the shape of the container neck relative to the cap often requires a relatively large twisting force be applied before the engaged cams, ribs, or threads will disengage to release the cap from the container.

Each of the aforementioned modes for removing the cap from the container requires the user to apply a relatively large force to overcome the engaged relationship of the cams, ribs, or threads on the cap and container or to apply a dual set of forces, such as in the combined push-and-twist removal system. Therefore, such container closures often pose difficulties for persons with little hand strength, such as the elderly and the disabled.

It would be advantageous to provide a container system that lacks the disadvantages of the container systems described above while simultaneously being attractive and of simple design, allowing for ease in manufacture.

Brief Summary of the Invention

The present invention concerns containers and closures having cross-sectional geometries that provide space efficiency in shipping, storage, and on-shelf display. The "cubic efficiency" of the containers and closures of the present invention provide approximately 25% to 30% savings in shelf space, as compared to conventional cylindrical containers. In addition to volumetric efficiency, the containers and closures of the invention can be reliably interlocked and resealed. The containers and closures can be used in conjunction with a varicty of seals that allow containment of pressure pack, liquid pack, and dry pack goods. The containers of the invention can also be designed for maximum cleanability.

Certain embodiments of the present invention include a precision designed "snap-on/pop-off" feature to withstand relatively high internal pressure or partial vacuums without leakage. Thus, the containers of the present invention are capable of remaining closed and sealed at partial vacuums (*e.g.*, up to about 10 psia) and at internal pressures up to about 40 psia.

The present invention further pertains to container systems comprising containers and corresponding closures of the invention. The container system of the present invention includes a container with a neck finish terminating in a rim, defining an opening (also referred to herein as the mouth of the container); and a closure (lid), wherein both the container and the lid have substantially polygon-shaped cross-sections.

The container system of the present invention further includes a partial (discontinuous) thread design that includes a plurality of locking tabs on the inner surface of the skirt portion of the lid and a plurality of complementary non-helical (coplanar) locking tabs on the cylindrical neck of the container, which function as external thread elements, slidably engaging with the locking tabs of the lid to provide a locking mechanism, and permitting the lid to be operated in a "press-on/twist-off fashion" with either a clockwise or counterclockwise twist of the lid. The container locking tabs are preferably rigid, and the lid locking tabs are preferably more flexible than the container locking tabs. Preferably, the container locking tabs are dual-beveled, as shown in Figure 1, facilitating an easier twist of the lid either clockwise or counterclockwise.

The container system of the present invention further includes a means for providing a fluid-tight seal between the lid and the container. The sealing means can be two concentric annular retaining walls (also referred to herein as a dual annular seal) protruding from the inner surface of the lid, which engage with the circular rim, as shown in Figures 6A and 6B, resulting in contact between three surfaces and improved leakage resistance. Other means for providing a fluid-tight seal are described in detail herein, including the Figures.

Preferably, the container system further includes a means for stacking the container of one container system superadjacently to the lid of another container system. The cross-section of the container is substantially square-shaped or rectangle shaped. Preferably, the cross-sections of both the container and the lid are substantially square-shaped or rectangle-shaped. The neck finish of the container is cylindrical and the rim is substantially circular.

The stacking means permits container systems of the present invention to be vertically stacked. The stacking means can include, for example, one or more flanges that extend upwardly from the peripheral edge of the lid, each flange having a topographical feature (such as a protrusion or recess) on its inner surface for frictionally engaging (also referred to herein as interlocking) with a complementary topographical feature (such as a protrusion or recess) on the outer surface of a wall of a superjacent container, near its base, as shown in Figure 3; or a plurality of protrusions that extend upward from the upper surface of the lid and engage with complementary dimples on the bottom wall (base) of a superjacent container. The container system of the present invention can be used for shipping, storing, and retail display of foodstuffs, such as prepared meats; vegetables; baby foods; fruits; sauces; dry foods, such as candy, nuts, and spices; as well as juices, and other beverages.

Preferably, the containers of the present invention further include a means for lifting the lid (more particularly, a means for lifting the lid locking tab) and a means for spreading the skirt of the lid from the neck of the container (collectively referred to herein as the "snap-on/pop-off" feature, as indicated above). The lifting means is a surface feature on the walls or neck of the container. Preferably, the lifting means is a lifting cam extending outwardly from the neck of the container, over which the lid locking tab slides as the lid is being removed. The spreading means is a surface feature on the neck of the container. The spreading means is preferably a spreading

cam extending outwardly from the neck of the container, over which the outermost edge of the lid locking tab slides, thereby spreading the flexible lid from the neck of the container. The lifting means and the spreading means cooperate (as a "snap on-pop off" feature) to guide the lid locking tab from engagement with the container locking tab in a precise manner, thereby efficiently lifting and spreading the flexible lid from the neck of the container, thus minimizing the amount of torque necessary to remove the lid from the container. In this way, the lid will literally "pop-off" in one's hand when the lid is lightly twisted clockwise or counterclockwise.

In another aspect, the present invention concerns a method for packaging a product, such as a food or beverage, within a container system of the present invention, by placing the product within the container and engaging the lid with the container. Optionally, sealing means can be positioned on or within the container neck, beneath the lid, in order to facilitate a liquid-tight seal.

In another aspect, the present invention concerns a method for packaging and display, involving providing a container and a lid, such as those of the present invention, and color-coding the lid or the container, or both the lid and the container, to the type of product contained (or to be contained) within the container. In another embodiment, the method involves color-coding the lid or the container, or both the lid and the container, to the shelf-life of the product contained (or to be contained) within the container. In another embodiment, the lid is color-coded with the type of product contained within the container or to be contained within the container, and the container is color-coded with the shelf-life of the product contained within the container or to be contained within the container. In another embodiment, the container is color-coded with the type of product contained within the container or to be contained within the container, and the lid is color-coded with the shelf-life of the product contained within the container or to be contained within the container.

Brief Description of Drawings

Figure 1 shows a container of the present invention. A plurality of dual-beveled external thread elements are shown extending outwardly from the cylindrical neck of the container.

Figures 2A and **2B** show lids of the present invention. Figure 2A shows a lid with two flanges that extend upwardly from the upper edge of the lid, each flange having a protrusion on its inner surface for frictionally engaging (also referred to herein as interlocking) with a complementary ridge on the outer surface of a corresponding wall of a superjacent container, near its base. Figure 2B shows a lid with four flanges that extend upwardly from the peripheral edge of the lid, each flange having a protrusion on its inner surface for frictionally engaging with a complementary ridge on the outer surface of a corresponding wall of a superjacent container, as shown in Figure 3. It should be understood that any of a variety of other similar flange geometries can be employed to provide the interlocking feature of the present invention.

Figure 3 shows a container of the present invention, with a lid of the present invention engaged with the base of the container, in a vertically stacked arrangement. As shown in Figure 3, the lid has four flanges (two of which are shown) extending upwardly from the peripheral edge of the lid. Each flange has a protrusion on its inner surface that is frictionally engaged with a complementary ridge on the outer surface of each corresponding wall on the container. In this embodiment, the complementary ridge runs all the way around the bottom portion of the container, as shown in Figure 3.

Figures 4A-4C show a container of the present invention (Figure 4A), a lid of the present invention (Figure 4B), and a vertical cross-sectional view of the lid engaged with the bottom portion of the container (Figure 4C). The container locking tabs are not shown in Figure 4A. Figure 4B shows a lid with four flanges extending upwardly from the peripheral edge of the lid. The protrusion on the inner surface of each flange is also shown. Figure 4C shows a vertical cross-section of a flange extending upwardly from the peripheral edge of the lid. As shown in Figure 4C, the upwardly extending flange has a protrusion on its inner surface that is frictionally engaged with a complementary ridge on the outer surface of the corresponding wall of the superjacent container.

Figures 5A-5C show various views of the top portion of a container of the present invention. Figure 5A shows a top planar view of the container, with the locking tab, spreading cam, and lifting cam indicated. Figure 5B shows a planar view of the left side of the container, with locking tab, spreading cam, and lifting cam indicated. Figure 5C shows a vertical cross-

sectional view of the left side of the container, with the locking tab, spreading cam, and lifting cam indicated. In this embodiment, the upper portion of the container's outer walls functions as a lifting surface (lifting cam), providing continuous upward force on the lower edge of the lid. In other embodiments, such as those shown in Figures 9A-9C, 11A-11C, 12A-12C, 13A-13B, 14A-14B, and 15-18, the lifting cam is a member that extends outward from the outer surface of the container neck, providing an upward sloping surface with which the lid locking tab engages as the lid is rotated. In these latter embodiments, the lifting cam is shaped as (and functions as) a ramp, applying upward force only when required to "pop-off" the lid when the lid is spread and initially coming off of the container locking tab.

Figures 6A and **6B** show a bottom planar view and a vertical cross-sectional view of a lid of the present invention, respectively. The dual annular seal, locking tabs, and bottom edge of the lid are shown.

Figures 7A and **7B** show a horizontal cross-sectional view and a vertical cross-sectional view, respectively, of a container system of the present invention, including a lid and container of the present invention in an engaged arrangement. The spreading cam of the container and the locking tabs of the lid are shown in Figures 7A and 7B. As shown in Figure 7B, the dual annular seal makes contact on three surfaces about the rim of the container.

Figures 8A-8C show spatial relationships between a container and lid of the present invention during rotation of the lid. As shown in Figure 8A, when the lid is rotated about 5 degrees in a clockwise or counterclockwise direction from a closed position, the locking tab on the lid comes into contact with the spreading cam of the container. At this point of rotation, the lid is still firmly secured over the opening of the container. When the lid is rotated further to about 10 degrees, as shown in Figure 8B, the locking tab of the lid is in full contact with the spreading cam of the container, and some lid deflection is present. The bottom edge and inner surface of the lid skirt is in full contact with the container's shoulder, which acts as a lifting cam in this embodiment, as shown in Figure 8B. The lid is still secured over the opening of the container at this point in the lid's rotation. When the lid is rotated further to about 15 degrees of rotation, the locking tab of the lid reaches full spreading cam deflection and is no longer in

contact with the locking tab of the container (also referred to herein as the locking cam of the container). At this point, the lid is independent of the container.

Figures 9A-9C show various views of the top portion of a container of the present invention, wherein the container has lifting cams. Figure 9A shows a top planar view of the container. Figure 9B shows a side planar view of the container. The locking tab, spreading cam, and lifting cam are shown in Figures 9A and 9B. Figure 9C shows a vertical cross-sectional view of the top portion of the container, with the locking tab and spreading cam of the container shown.

Figures 10A and **10B** show a vertical cross-sectional view and a bottom planar view of the container of the present invention, respectively. The dual annular seal and locking tabs are seen in Figures 10A and 10B.

Figures 11A-11C show various views of a lid and top portion of a container of the present invention. Figure 11A shows a horizontal cross-sectional view of container with the lid engaged, covering the opening of the container. Figure 11B shows a side planar view of the container with only the locking tab of the lid shown. The spreading cam, locking tabs, and lifting cams of the container are shown in Figures 11A and 11B. Figure 11C shows a vertical cross-sectional view of the container and lid, showing the dual annular seal on the inner surface of the lid engaged with the circular rim of the container. The locking tabs and spreading cam are also shown. The lifting cam is not shown in Figure 11C.

Figures 12A and **12B** show a horizontal cross-sectional view and a side planar view of the container and lid shown in Figures 11A-11C, wherein the lid has been rotated about 5 degrees from a securely closed orientation. Only the locking tab of the lid is shown in Figure 12B. As shown in Figures 12A and 12B, at 5 degrees of rotation of the lid, the lid locking tab comes into contact with the container spreading cam. The lid is still firmly secured over the opening of the container.

Figures 13A and **13B** show a horizontal cross-sectional view and a side planar view of the container and lid shown in Figures 12A and 12B, wherein the lid has been rotated about 10 degrees from a securely closed orientation. Only the locking tab of the lid is shown in Figure 13B. As shown in Figures 13A and 13B, at 10 degrees of rotation of the lid, the lid locking tab is

in full contact with the container spreading cam, and lid deflection is present. The corner of the lid locking tab is in contact with the container lifting cam. Lifting force is being applied. The lid is still firmly secured over the opening of the container.

Figures 14A and **14B** show a horizontal cross-sectional view and a side planar view of the container and lid shown in Figures 13A and 13B, wherein the lid has been rotated about 15 degrees from a securely closed orientation. Only the locking tab of the lid is shown in Figure 14B. As shown in Figures 14A and 14B, the lid locking tab reaches full spreading cam deflection and is no longer in contact with the container locking tab. The container lifting cam delivers upward force, assisting the lid locking tab off of the container locking tab and breaking any seal that is present over the mouth of the container. At this point, the lid is independent of the container.

Figure 15 shows a partial perspective view of a container and lid of the present invention, wherein the container has lifting cams and the container and lid are in a securely closed orientation (*i.e.*, from a position where the lid locking tab is in slidable contact with the container locking tab, and where the lid locking tab is located exactly on center via the cam arrangement between the container's left and right spreading cams and the container's left and right lifting cams). This self-centering design insures that maximum hold down force is always available to insure consistent high pressure locking because the locking tabs are always fully engaged at this point. The locking tabs of the lid and the container are shown in sliding contact with one another (only the locking tab of the lid is shown). The lifting cams and spreading cams of the container are also shown.

Figure 16 shows a partial perspective view of the container and lid shown in Figure 15, wherein the lid is rotated about 5 degrees from a securely closed orientation. As shown in Figure 16, the lid locking tab comes into contact with the container spreading cam. At this point of lid rotation, the lid is still firmly secured over the mouth of the container.

Figure 17 shows a partial perspective view of the container and lid shown in Figure 16, wherein the lid is rotated about 10 degrees from a securely closed orientation. As shown in Figure 17, the lid locking tab is in full contact with the container spreading cam, and lid deflection is present. The corner of the lid locking tab is in contact with the container lifting

cam, as shown in Figure 17. Lifting force is being applied. At this point of lid rotation, the lid is still firmly secured over the mouth of the container.

Figure 18 shows a partial perspective view of the container and lid shown in Figure 17, wherein the lid is rotated about 15 degrees from a securely closed orientation. As shown in Figure 18, the lid locking tab reaches full spreading cam deflection and is no longer in contact with the container locking tab. The container lifting cam delivers upward force assisting the lid locking tab off the container locking tab and breaking any seal present over the opening. Spreading and lifting forces will overcome any locking force. The lid is independent of the bottle at this point of lid rotation.

Figures 19A-19C show various views of a container and lid of the present invention, wherein the container system includes a stopper plug seal. Figure 19A shows a horizontal cross-sectional view of the lid, container, and stopper plug seal. Figure 19B shows side planar view of the stopper plug seal. Figure 19C shows a vertical cross-sectional view of the container, lid, and stopper plug seal. As shown in Figure 19C, the stopper plug seal has a means for lifting the stopper plug seal of the mouth of the container, such as a handle. Preferably, the handle of the stopper plug seal has a gap (*e.g.*, about ¼ inches in height) permitting the stopper plug seal to be opened by placing the end of a spoon or other implement into the gap. In this embodiment, the inner surface of the neck of the container requires a draft angle for molding purposes, such that the neck of the container is narrower at its base than at the rim of the container, as shown in Figure 19C. In addition, as shown in Figure 19C, the base of the inner surface of the container neck has a hard stop to prevent the stopper plug seal from being pushed downward beyond the hard stop.

Figures 20A-20C show various views of a container and lid of the present invention, wherein the container system includes a lower profile stopper plug seal. In this embodiment, the hard stop is large to ensure that the stopper plug seal is not pushed down passed the hard stop. In this embodiment, the plug handle is composed a semi-pliable material that can be compressed from above by the inner surface of the lid when it is placed on the container, as shown in Figure 20C, leaving about a $3/16^{th}$ inch gap in the plug handle.

Figures 21A-21C show various views of a container and lid of the present invention, wherein the container system includes a stopper plug seal with a raised tab and pocket (slot). The container can be opened by inserting a spoon end or other implement into the pocket, pinching the tab between the implement and a thumb, and prying off the stopper plug seal.

Figures 22A-22C show various views of a container and lid of the present invention, wherein the container system includes a loose-fitting seal composed of semi-pliable material that can be easily removed. As shown in Figure 22C, sealing is established through compression of seal material from the cap and the hard stop.

Figures 23A-23C show various views of a container and lid of the present invention, wherein the container system includes a loose-fitting seal composed of a rigid material that can be easily removed. As shown in Figure 23C, sealing is established through exerted force from the lid sufficient to deflect the plug and force the seal against the hard stop.

Figures 24A-24D show various views of a container and seal of the present invention, wherein the container has a seal stop projecting inward from the inner surface of the container neck, and the seal stop is part of the draft to facilitate molding of the article.

Figure 25 shows the top portion of a container of the present invention, wherein container includes a gate valve seal and a seal groove. As shown in Figure 25, the seal groove, which is preferably about half of the thickness of the container rim, exists around one half the diameter of the rim. Coplanar with the seal groove is an opening through the rim, making up the other half of the diameter.

Figures 26A and **26B** show a top view of the rim of a container of the present invention and a vertical cross-sectional view of the container and a lid of the present invention, respectively. As shown in Figure 26A, the seal groove, which is about one-half the thickness of the container rim, exists around one-half of the inside diameter of the rim. Coplanar with the seal groove is an opening through the rim making up the other half of the diameter.

Figures 27A and **27B** show, respectively, a perspective view of the container shown in Figures 26A and 26B, and a perspective view of a gate valve seal of the present invention. The forward seal radius matches the radius of the inside container rim groove. Stopping tabs on the center axis facilitate proper positioning of the gate valve seal. External radii are designed so as

not to interfere with the lid locking tabs during closure of the container. Corner tabs on the gate valve seal can function for seal removal.

Figures 28A and **28B** show a top view of the rim of a container of the present invention and a top view of the gate valve seal shown in Figure 27B, respectively. The forward seal radius matches the radius of the inside container rim groove. Stopping tabs on the center axis facilitate proper positioning of the gate valve seal on the container. External radii are designed so as not to interfere with the lid locking tabs during closure. Corner tabs on the gate valve can function for seal removal. The corner tabs start and end points are designed so as not to interfere with the lid locking tabs during twisting for disassembly.

Figure 29 shows a partial perspective view of a container and gate valve seal of the present invention in an assembled position.

Figure 30 shows a top planar view of a container and gate valve seal of the present invention in an assembled position.

Figure 31 shows a vertical cross-sectional view of a container and lid of the present invention. Direct interference between the container and the lid achieved by the dual annular seal.

Figures 32A and **32B** show a top planar view of a container and fused (*e.g.*, glued or otherwise adhesively bonded) seal of the present invention, and a vertical cross-sectional view of the container, fused seal, and lid of the present invention.

Figures 33A and **33B** show vertical cross-sectional views of containers and lids of the present invention. Figure 33A shows an embodiment of the container and lid, wherein a trapped and compressed O-ring is positioned between the rim of the container and the dual annular seal. Figure 33B shows another embodiment of the container and lid with a trapped and compressed O-ring, wherein the concentric retaining walls of the annular seal are shortened, in comparison to the embodiment in Figure 33A.

Detailed Disclosure of the Invention

The container system of the present invention includes a container with a neck finish terminating in a rim, which defines an opening (also referred to herein as the mouth of the

container); and a closure (lid), wherein both the container and the lid have substantially polygon-shaped cross-sections. The cross-section of the container is substantially square-shaped or rectangle shaped. Preferably, the cross-sections of both the container and the lid are substantially square-shaped or rectangle-shaped. The neck finish of the container is cylindrical and the rim is substantially circular.

The container system of the present invention further includes a partial (discontinuous) thread design that includes a plurality of locking tabs on the inner surface of the skirt portion of the lid and a plurality of complementary non-helical (coplanar) locking tabs on the cylindrical neck of the container, which function as external thread elements, slidably engaging with the locking tabs of the lid, permitting the lid to be operated in a "press-on/twist-off fashion" with either a clockwise or counterclockwise twist of the lid. Preferably, the container locking tabs are dual-beveled, as shown in Figure 1, facilitating an easier twist of the lid either clockwise or counterclockwise. Preferably, there are an equal number of lid locking tabs and container locking tabs in each container system. Preferably, there are four lid locking tabs and four container locking tabs. The shapes of the lid locking tabs and container locking tabs are not critical, so long as they can engage (interlock) with one another as needed.

The container system of the present invention further includes a means for providing a fluid-tight seal between the lid and the container. The sealing means can be two concentric annular retaining walls (also referred to herein as a dual annular seal) protruding from the inner surface of the lid, which engage with the circular rim, as shown in Figures 6A and 6B, resulting in contact between three surfaces and improved leakage resistance. Other means for providing a fluid-tight seal are described in detail herein. The preferred sealing means will depend upon the product's packaging requirements. For example, some products should have a tamper proof adhesive bonded or fused membrane seal, in addition to, or instead of, those seals disclosed herein. For example, pressure pack, liquid pack, and dry pack goods can be packaged in container systems of the invention having sealed (*e.g.*, welded or glued) membranes, integral soft compression seals, or friction or interference seals, as appropriate.

Preferably, the containers of the present invention further include a means for lifting the lid (more particularly, a means for lifting the lid locking tab) and a means for spreading the skirt

of the lid from the neck of the container. The lifting means is preferably a lifting cam extending outwardly from the neck of the container, over which the lid locking tab slides as the lid is being removed. For example, the lifting cam can be an element having an upper surface that slopes upward to guide the lid locking tab upward, as shown in Figure 15. The spreading means is preferably a spreading cam extending outward from the neck of the container, over which the outermost edge of the lid locking tab slides, thereby spreading the skirt portion of the flexible lid outward, away from the neck of the container. For example, the spreading cam can be an element having the shape of a two-sided ramp, as shown in Figure 15. The number of lifting cams and spreading cams can vary. Preferably, there are two lifting cams and two spreading cams for each lid locking tab. The lifting means and the spreading means cooperate (as a "snap on-pop off" feature) to guide the lid locking tab from engagement with the container locking tab in a precise manner, thereby efficiently lifting and spreading the flexible lid away from the neck of the container, thus minimizing the amount of torque necessary to remove the lid from the container. In this way, the lid will literally "pop-off" in one's hand when the lid is lightly twisted clockwise or counterclockwise. Advantageously, the containers of the present invention are capable of remaining closed and sealed at partial vacuums (*e.g.*, up to about 10 psia) and at internal pressures up to about 40 psia, without compromising the ease with which the consumer is able to open and close the containers.

Preferably, the container system further includes a means for stacking the container of one container system superadjacently to the lid of another container or container system. The cross-section of the container is substantially square-shaped or rectangle shaped. Preferably, the cross-sections of both the container and the lid are substantially square-shaped or rectangle-shaped.

The stacking means permits container systems of the present invention to be vertically stacked. The stacking means can include, for example, one or more flanges that extend upwardly from the peripheral edge of the lid, each flange having a topographical feature (such as a protrusion or recess) on its inner surface for frictionally engaging (also referred to herein as interlocking) with a complementary topographical feature (such as a protrusion or recess) on the outer surface of a wall of a superjacent container, near its base, as shown in Figure 3; or a

plurality of protrusions that extend upwardly from the upper surface of the lid and engage with complementary dimples on the bottom wall (also referred to herein as the base) of a superjacent container.

The container of the present invention is hollow to accommodate a product, such as a food or beverage, and has a polygon-shaped cross-section. Throughout this detailed discussion, embodiments of containers and closures having four sides are described. However, it should be understood that the containers and closures of the present invention can have three sides at any angle to one another *(e.g.*, triangle shaped cross-section); four sides, each of which may be of any length (*e.g.*, square or rectangle shaped cross-section), or more sides. For example, containers and closures with pentagonal, hexagonal, septagonal, or octagonal-shaped cross-sections can be constructed. Preferably, the container and corresponding closure have the same number of sides.

The container generally includes four walls (front wall, back wall, right side wall, and left side wall) and a bottom (also referred to herein as a base). The four walls and the base have an inner surface and an outer surface. Directional designations are in reference to the container positioned vertically as shown in Figure 1 for the purposes of this description. It should be understood, however, that turning or rotating the container may reverse the references as designated above. As can be seen from Figure 5A, the front wall and back wall are preferably substantially parallel and generally flat, although they can be slightly arcuate. The left wall and right wall are preferably substantially parallel and generally flat, although they can be slightly arcuate. It should be understood, however, that when the container is filled with a product, the walls may bulge slightly due to the internal forces exerted by the product as a result of its weight, vapor pressure, and other related forces. The container systems of the invention can be constructed in any of the common variety of sizes, or custom made for the particular product to be contained, which can include hot pack food, liquid, and dry goods, for example.

For embodiments of containers with square-shaped cross-sections, the walls are substantially the same length. For embodiments of containers with rectangle-shaped cross-sections, one pair of opposing walls are shorter than the other pair of opposing walls. Thus, for

embodiments with rectangle-shaped cross sections, either the front and back walls are shorter than the left and right walls, or the left and right walls are shorter than the front and back walls.

As can be seen in Figures 5A, the corners connecting the four walls of the container are preferably rounded, *i.e.* not square. Plastic containers of the present invention are generally manufactured by a blow-molding process. It is well known in the art that most blow-molded articles perform better with rounded, slanted and tapered surfaces. During the blow molding process, wall thickness can vary from side panels to corners. Square corners may turn out thin and weak, and flat heavy side walls may turn out thick and distorted. Therefore, it is preferred that the corners of the container are rounded. Furthermore, square corners prevent complete "clean out" of the product from the container with an implement such as a spoon. Therefore, the rounded corners of the containers of the present invention preferably describe an arc that approximates the arc at the end of a standard spoon, thereby ensuring that residual product, such as baby food, can be easily removed from the corners of the container (*i.e.*, improved cleanability).

The container of the present invention has an exterior length (between substantially parallel left and right walls) to width (between substantially parallel front and back walls) ratio that will depending upon the particular packaging needs of the distributor. The height of the container will vary depending upon the desired capacity of the container in relation to the actual length and width thereof. It is well within the capability of one skilled in the art to calculate the height given the length and width dimensions and/or dimensional ratios and the desired capacity of the container.

The walls of the containers and lids of the present invention can range in thickness depending upon the requirements of the particular application. For example, the walls of the containers can be within the range of about 0.25 millimeters to about 2 millimeters in thickness. The lids of the present invention can be within the range of about 1 millimeter and about 2 millimeters in thickness. Preferably, the lids of the present invention are about 1.5 millimeters in thickness. The walls of the containers and the lids of the present invention can have a substantially constant thickness, or a thickness that varies depending upon the area of the container or lid.

Each of the four walls provide a surface for labeling. An adhesive label bearing printed matter can be applied to the outer surface of one or more of the four walls. Alternatively, printed matter can be applied directly to the outer surface of one or more of the four walls.

The container of the present invention can be constructed of any of a variety of rigid materials, such as plastic or glass. The container of the present invention is preferably constructed of a plastic or similar material that is suitable for blow-molding such as, for example, a typical blow-molding grade of high density polyethylene. More preferably, the container of the present invention is constructed of polyethylene terephthalate (PET), a thermostable plastic, which permits the placement of a hot foodstuff within the container during packaging without deformation of the container. The container of the present invention can be fabricated by any one of a number of well known molding techniques such as, for example, blow molding or any other method capable of shaping the chosen material, such as plastic, into the desired shape. The container is preferably manufactured by stretch blow molding using an injection molded perform. The process of stretch blow molding is well known in the art.

The lid of the present invention can be constructed of any suitable deformable material or materials, such as plastic with some degree of flexibility. Preferably, the lid is constructed of low density to high density polyethylene or polypropylene. The lid is preferably not PET. The containers and lids of the present invention can be transparent, translucent, opaque, or colored. For example, the containers and lids of the invention can be color-coded as described below.

In another aspect, the present invention concerns methods for packaging a substance, such as food or beverages, using the container systems of the invention. According to the method of the present invention, a product is placed in a container of the invention and a lid of the invention is engaged with the mouth of the container. Optionally, a means for sealing, such as an elastomeric membrane or O-ring, is placed between the container and the lid. For example, in those embodiments having a dual annular seal, an O-ring can be positioned between the two retaining walls of the dual annular seal, such that the O-ring provides an improved seal between the bottom surface of the lid and the rim of the container, as shown in Figures 33A and 33B. Alternatively, the O-ring can be integrally molded between the retaining walls of the dual annular seal. In other embodiments, such as those where the lid does not have a dual annular

seal, the sealing means can be a stopper plug seal. The stopper plug seal can be positioned within the neck of the container, as shown in Figures 19A-19C, 20A-20C, 21A-21C, 22A-22C, 23A-23C, and 24A-24D. As shown in Figures 19C, 20C, 21C, 22C, and 23C, the stopper plug seal is held in place by the lid from above and the hard stop within the neck of the container. Alternatively, the sealing means can be a gate valve seal. Where a gate valve seal is used, the neck of the container has a groove on its inner surface that is preferably half the thickness of the container rim, the groove extending around about one-half of the inside diameter of the neck, as shown in Figure 25. Coplanar with the groove is an opening through neck of the container that extends the other half of the diameter of the container neck, as shown in Figure 25. The gate valve seal is positioned on the container by inserting the forward portion of the gate valve seal through the opening in the neck of the container, until the forward portion of the gate valve seal contacts and engages with the groove on the inner surface of the container neck, as shown in Figures 27A and 27B. In other embodiments, a membrane can be placed between the lid and the container rim to serve as sealing means, as shown in Figures 32A and 32B. Optionally, the sealing means can have a tab for easily removing the sealing means, as shown in Figure 32A. Plug seals can be composed of any of various materials, such as polyethylene, polypropylene, or other elastic polymer. Gate valve seals can be constructed of materials such as PET or other rigid plastic. The method of the present invention can optionally include stacking (interlocking) container systems of the invention on a shipping or display surface. Methods and steps for operating the containers and lids of the present invention are further described in the Figures.

The product placed within the container of the present invention can be of various physical phases, such as solid, semi-solid, liquid, *etc.* The product placed within the container can be a food or beverage, for example. The product can be treated in any number of ways before or after being placed in the container. For example, foods can be cooked prior to being placed in the container. If the product is placed in the container in a heated state, the container should be composed of a material, such as thermoplastic, which can withstand the temperature of the heated product without loss of structural integrity. Preferably, the container is constructed of polyethylene terephthalate (PET).

Advantageously, the containers and closures of the present invention can be efficiently stacked and shipped on a standard 40 inch x 48 inch GMA (Grocery Manufacturers Association) pallet. This pallet size is the standard of the grocery industry by which the majority of warehouses, shipping trucks, and rail cars are constructed. By utilizing standard sized pallets, maximum space utilization for storage and shipping of a given product can be achieved. A plurality of tiers of containers of the present invention can be stacked on a single pallet.

In another aspect, the present invention concerns a method for packaging and display, involving providing a container and a lid, such as those of the present invention, and color-coding the lid or the container, or both the lid and the container, to the type of product contained (or to be contained) within the container. In another embodiment, the method involves color-coding the lid or the container, or both the lid and the container, to the shelf-life of the product contained (or to be contained) within the container. In another embodiment, the lid is color-coded with the type of product contained within the container or to be contained within the container, and the container is color-coded with the shelf-life of the product (*e.g.*, based on product processing or packaging date) contained within the container or to be contained within the container. In another embodiment, the container is color-coded with the type of product contained within the container or to be contained within the container, and the lid is color-coded with the shelf-life of the product contained within the container or to be contained within the container. For example, either the color of the lid or the color of the container can be coded with the variety of a food item, or its intensity, such as hot, medium, and mild. In this way, the colors of lids and/or containers can convey inventory or stock information to distribution personnel, such as grocery shelvers and management, and useful information about the product can be conveyed to the consumer, as well. It should be understood that the method for packaging and display of the present invention is not limited to the containers and closures disclosed herein. Any container and/or closure can be utilized.

The terms "container" and "bottle" are used interchangeably herein to refer to the containers of the present invention, without limitation to the materials with which they are constructed.

The terms "cap", "lid", and "closure" are used herein interchangeably to refer to the lids of the present invention.

The terms "lifting cam" and "cam ramp" are used herein interchangeably as examples of lifting means, which functions to provide an upward force to the lower edge of the lid. This upward force may be constant or only activated when the lid is twisted. In some embodiments, the lifting cam is a lifting surface at the shoulder of the container that provides constant upward force to the lower edge of the lid, such as those embodiments shown in Figures 5A-5C. In other embodiments, the lifting cam is a member that extends outward from the outer surface of the container neck, providing an upward sloping surface with which the lid locking tab engages as the lid is rotated, as shown in Figures 9A-9C, 11A-11C, 12A-12C, 13A-13B, 14A-14B, and 15-18, for example.

The terms "polygon", "polygonal", and "polygon-shaped" are use interchangeably herein to mean a shape with at least three sides. For example, a container or closure that has a polygon-shaped cross-section has three or more sides. Preferably, the containers and closures of the present invention have four sides.

The term "complementary topographical feature" refers to a feature on the surface of the lid or container of the present invention that is designed to physically interact with another feature on the surface of another lid or container. The physical interaction can be one of frictional engagement, where an amount of pressure is necessary to permit two complementary topographical features to engage and disengage. When two complementary features are frictionally engaged, there is a degree of resistance (frictional) to forces applied to disengage (separate) the complementary features.

All patents, patent applications, provisional applications, and publications referred to or cited herein are incorporated by reference in their entirety, including all figures and tables, to the extent they are not inconsistent with the explicit teachings of this specification.

It should be understood that the examples and embodiments described herein are for illustrative purposes only and that various modifications or changes in light thereof will be suggested to persons skilled in the art and are to be included within the spirit and purview of this application.

Abstract

The subject invention pertains to container systems that provide space efficiency in shipping, storage, and on-shelf display. The container and closure of the container system utilizes a cubic geometry so that adjoining containers pack tightly, as compared to cylindrical containers with circular cross-section. Certain embodiments of the present invention include a precision designed "snap-on/pop-off" feature to withstand relatively high internal pressure or partial vacuums without leakage. In another aspect, the present invention concerns methods for packaging a substance, such as food or beverages, using the container systems of the invention. In another aspect, the present invention concerns methods for packaging and displaying a product using color-coded containers and/or closures.

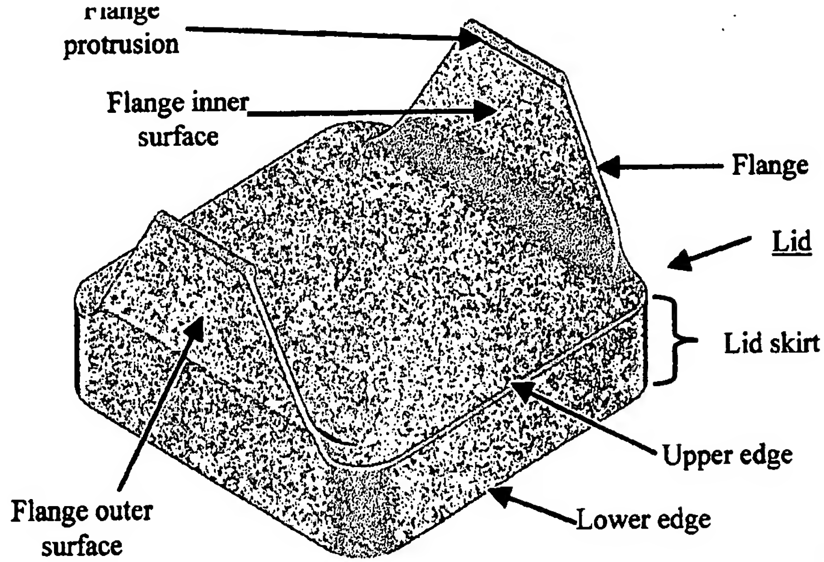


FIG. 2A

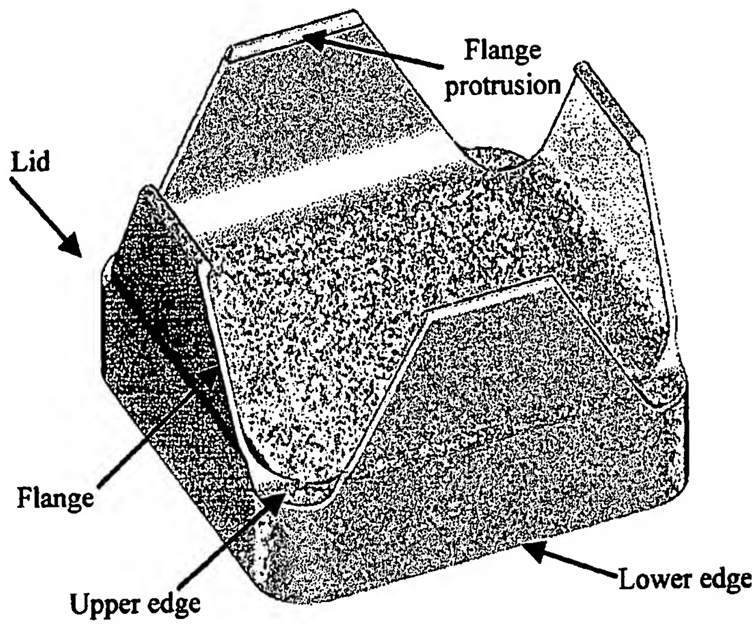


FIG. 2B

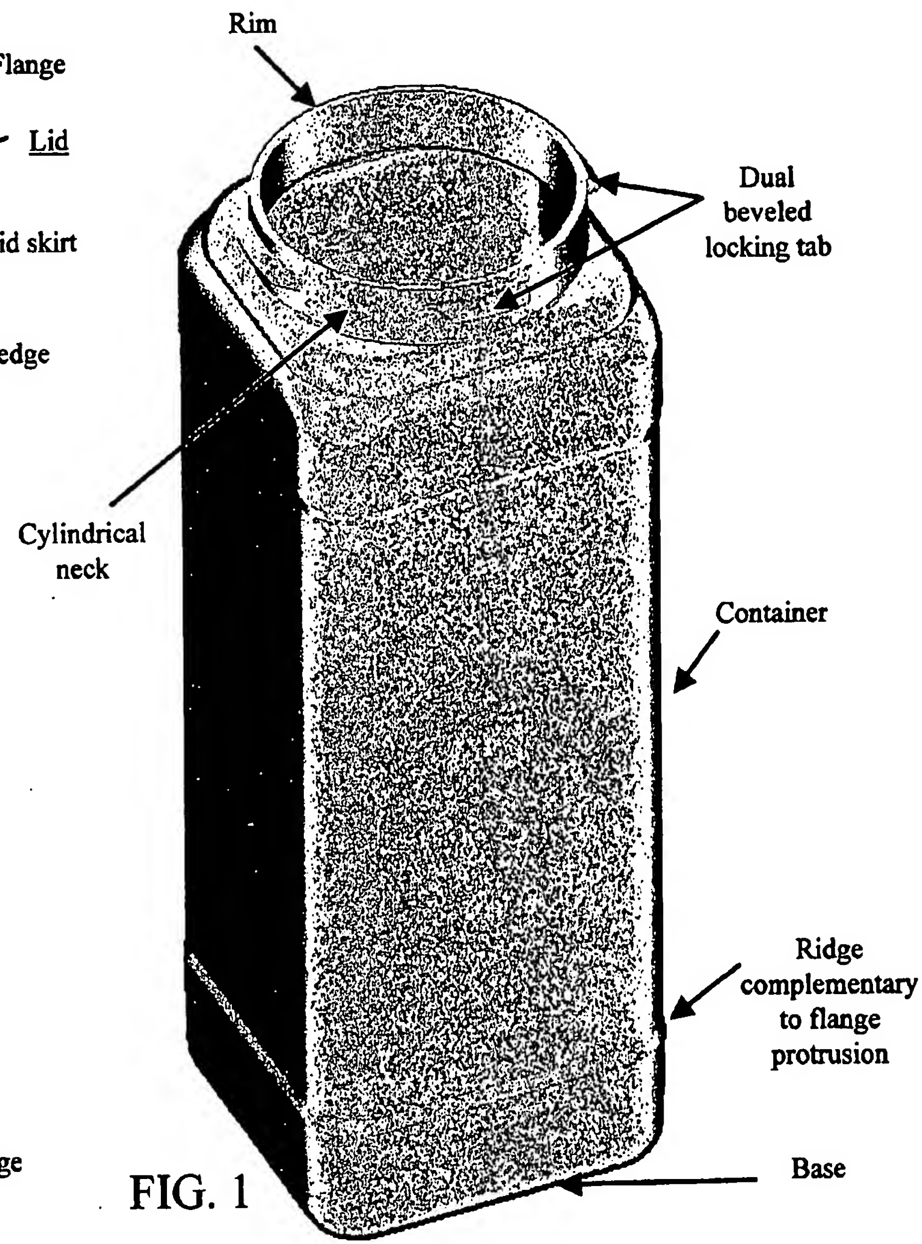


FIG. 1

60477759.061003

Container contained in cap locks

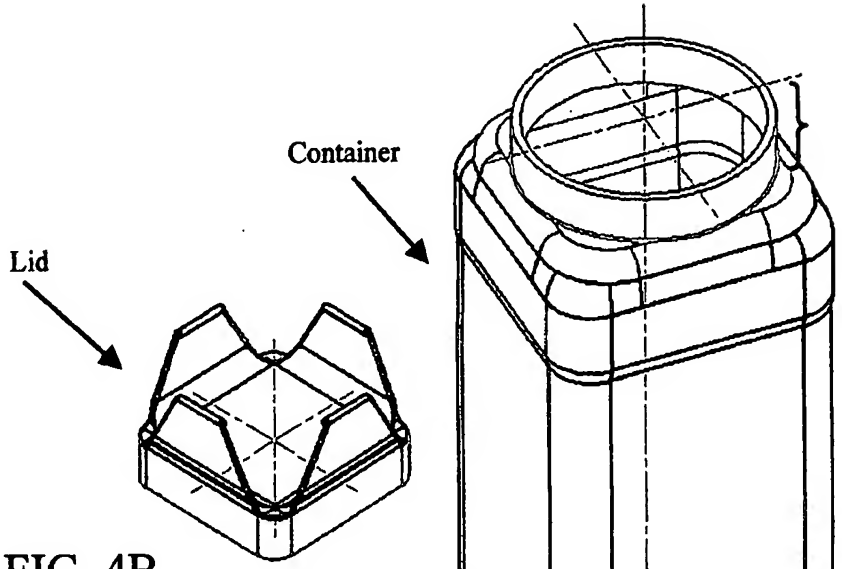


FIG. 4B

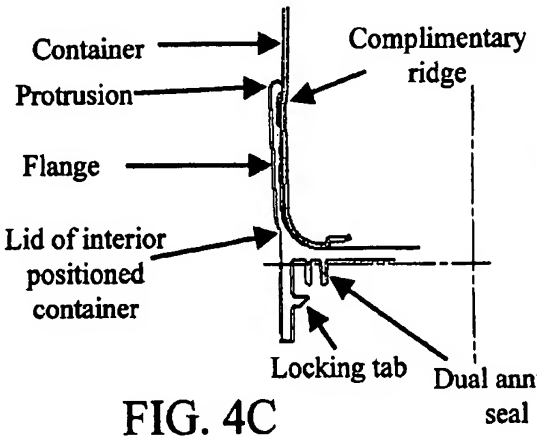


FIG. 4C

FIG. 4A

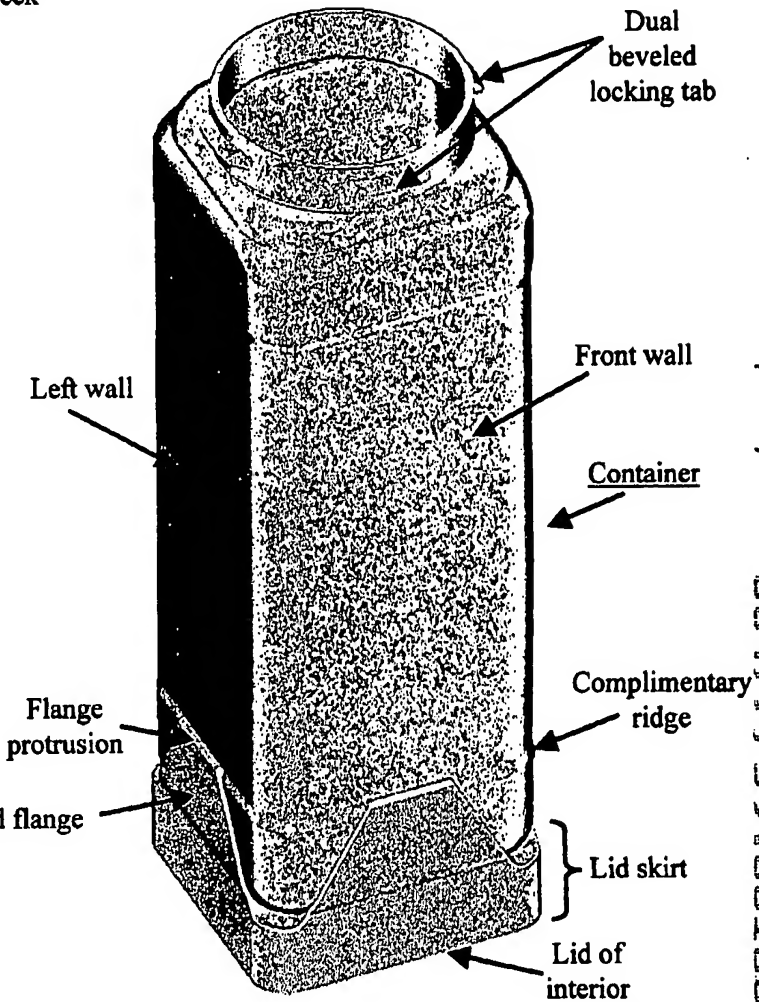


FIG. 3

Cap lock section with container

FIG. 5B

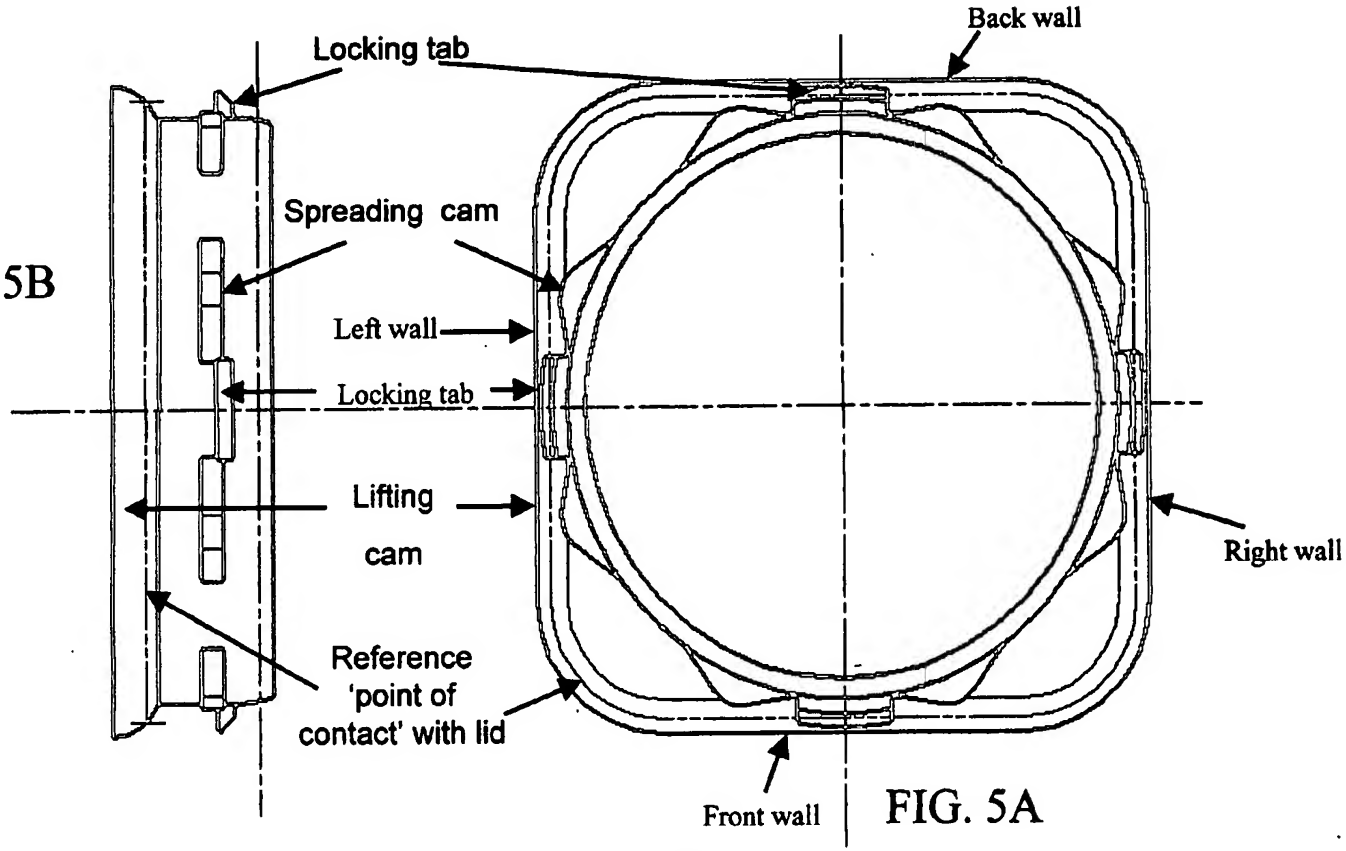


FIG. 5A

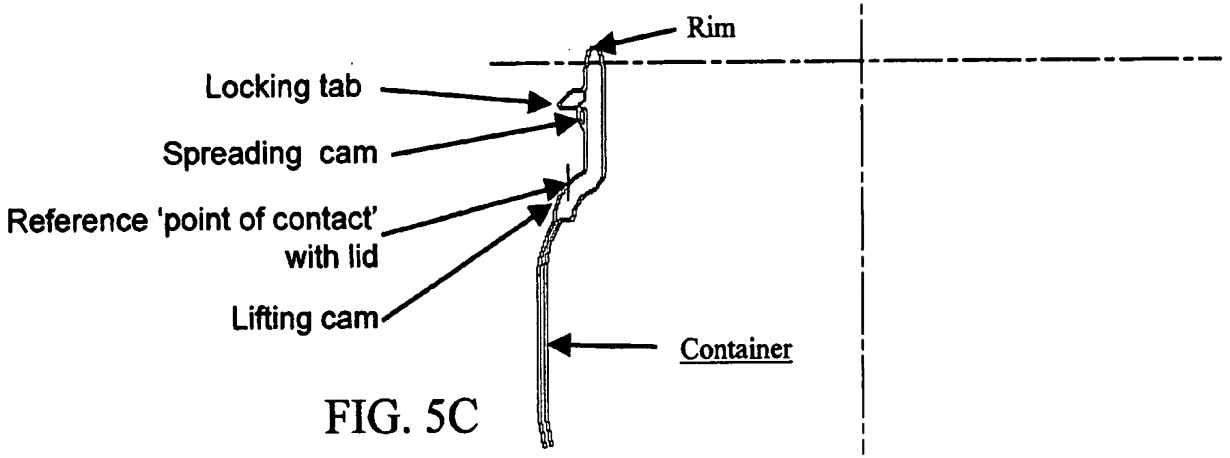


FIG. 5C

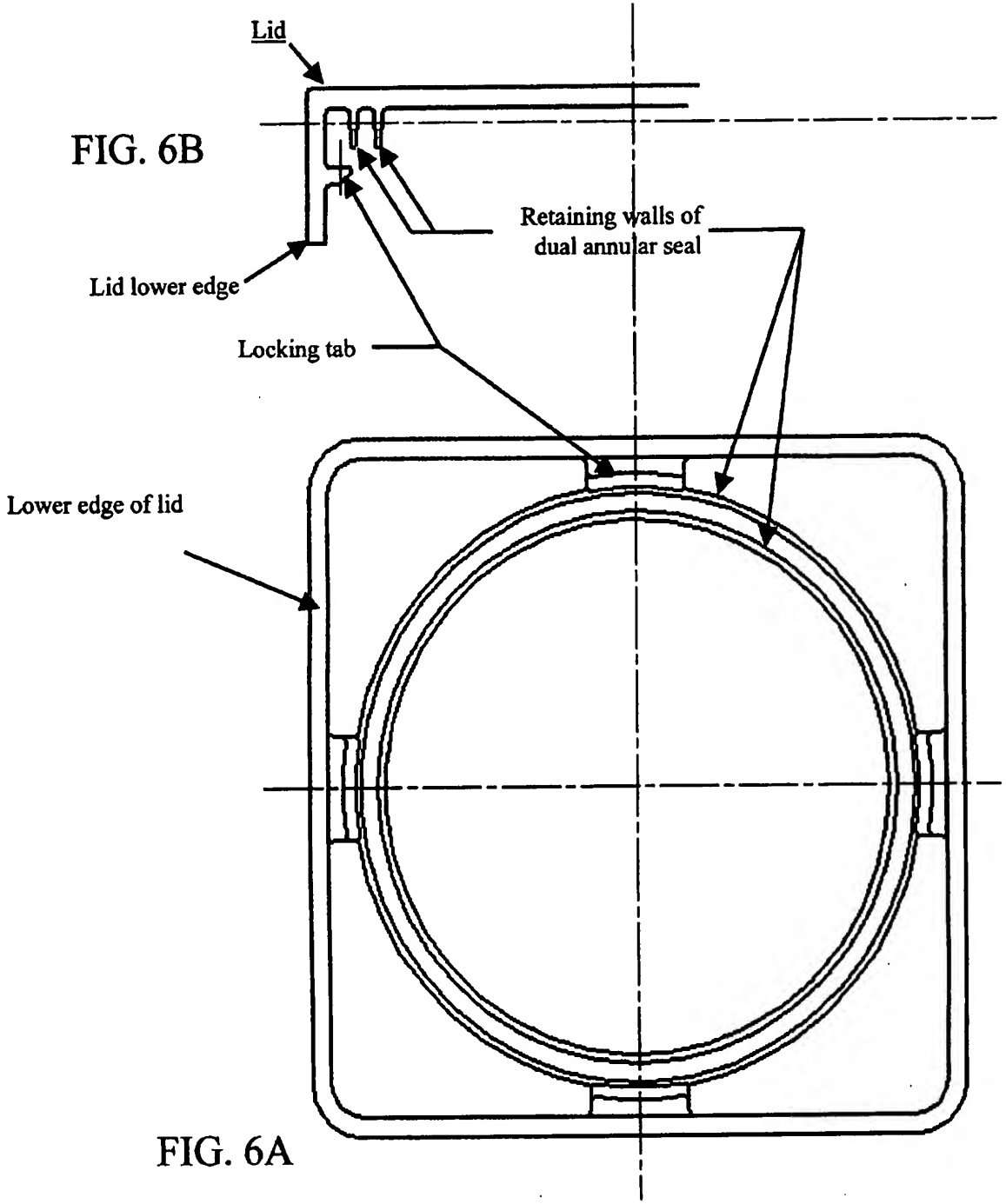


FIG. 6B

FIG. 6A

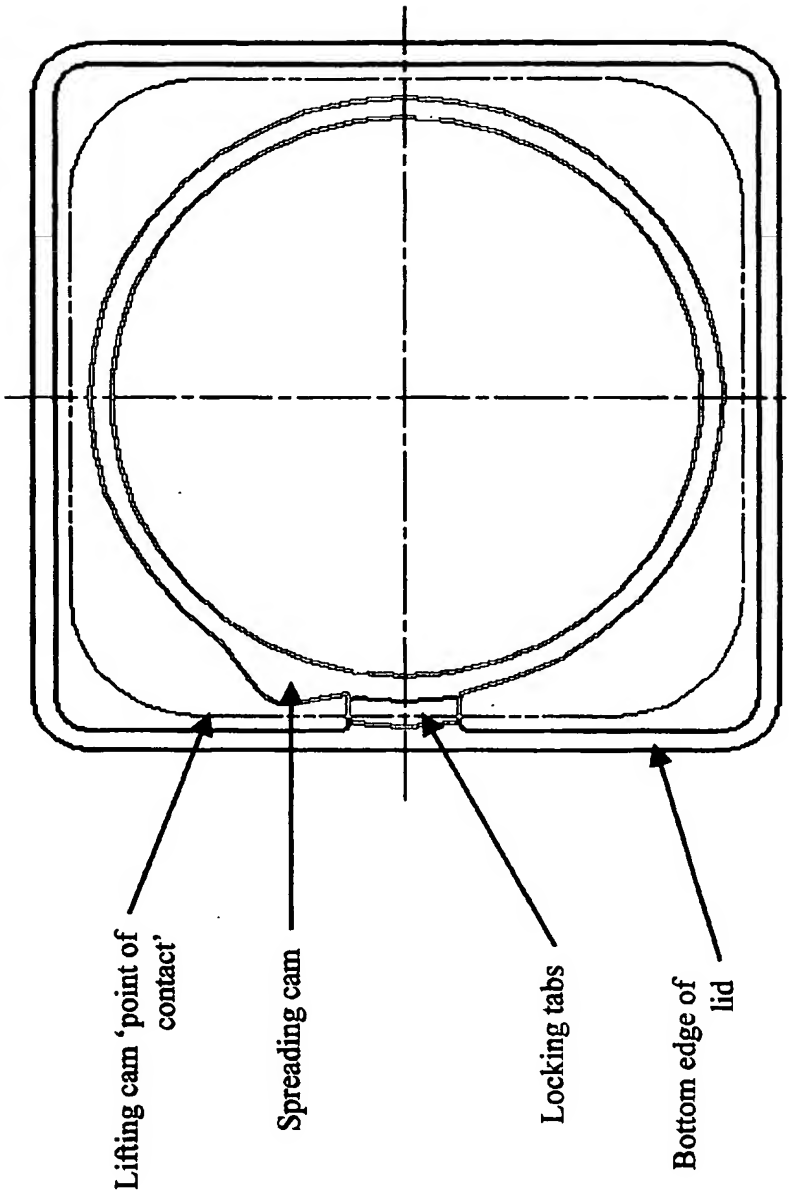

Lifting cam 'point of contact'
Spreading cam
Locking tabs
Bottom edge of lid

FIG. 7A

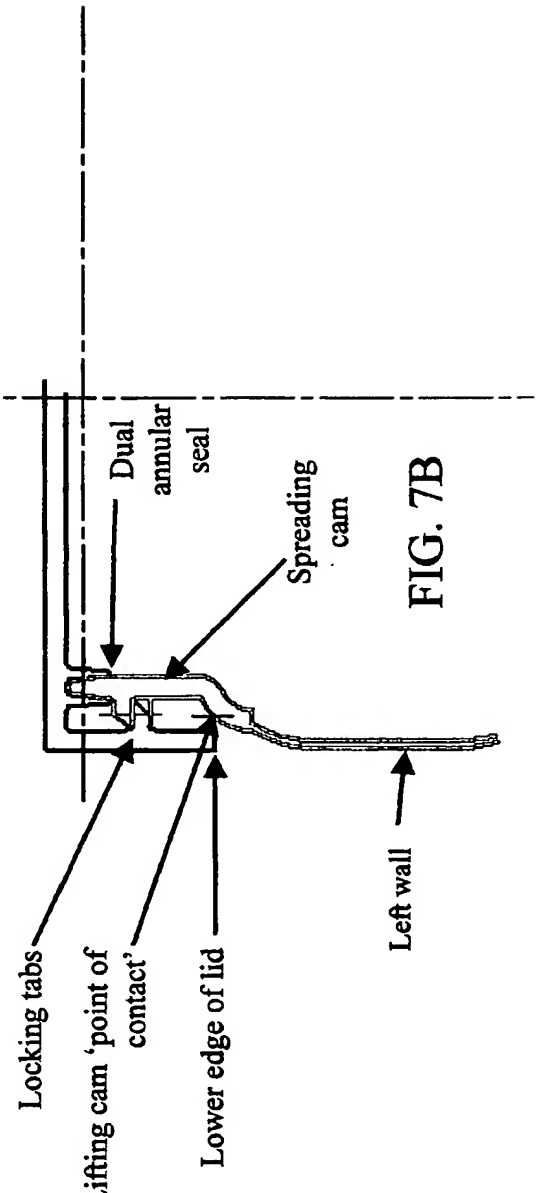

Locking tabs
Lifting cam 'point of contact'
Lower edge of lid
Left wall
Dual annular seal
Spreading cam

FIG. 7B

FIG. 8A

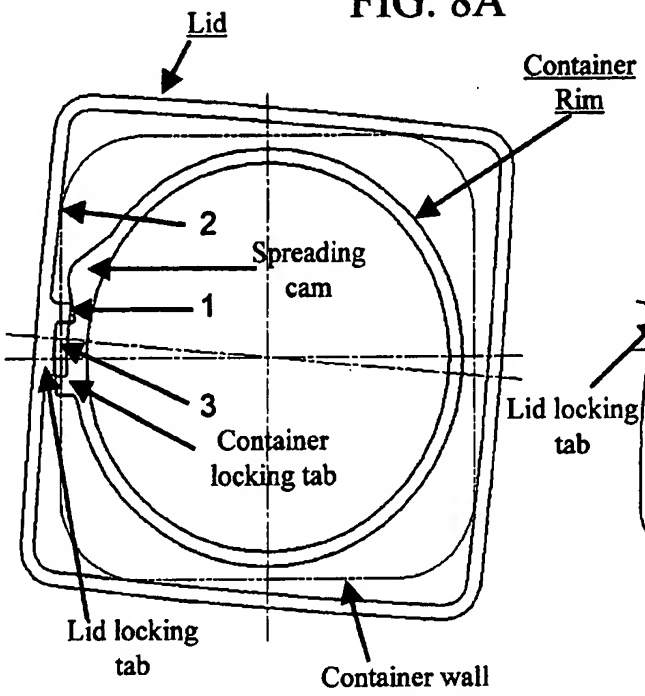


FIG. 8B

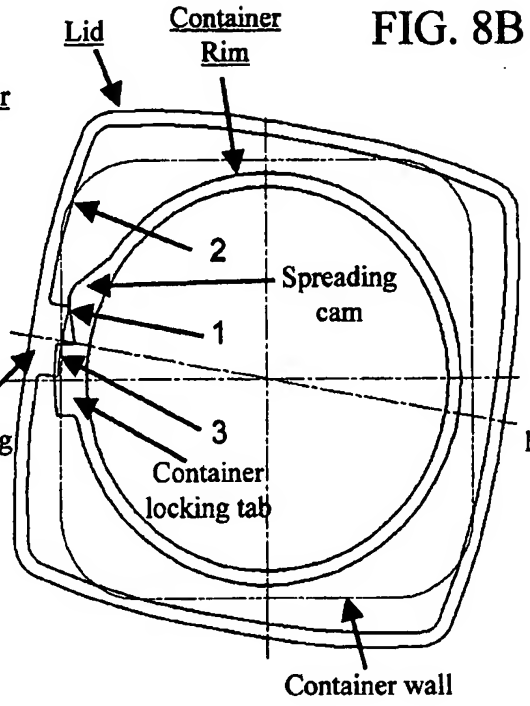
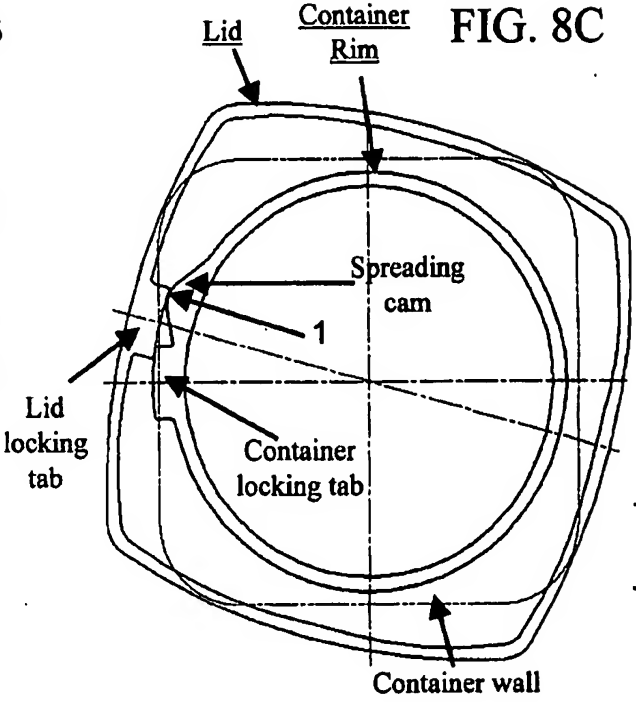


FIG. 8C



5 DEGREES OF ROTATION:

1. Lid locking tab comes into contact with container spreading cam.
2. Bottom edge of lid perimeter comes into contact with container lifting cam 'point of contact'.
3. Lid is still firmly secured with container.

10 DEGREES OF ROTATION:

1. Lid locking tab is in full contact with container spreading cam, and cap deflection is present.
2. Bottom edge of lid perimeter is in full contact with container lifting cam 'point of contact'. Lifting force is being applied.
3. Lid is still secured with container.

15 DEGREES OF ROTATION:

1. Lid locking tab reaches full spreading cam deflection and is no longer in contact with container locking tab.
2. Lid is independent of the container.

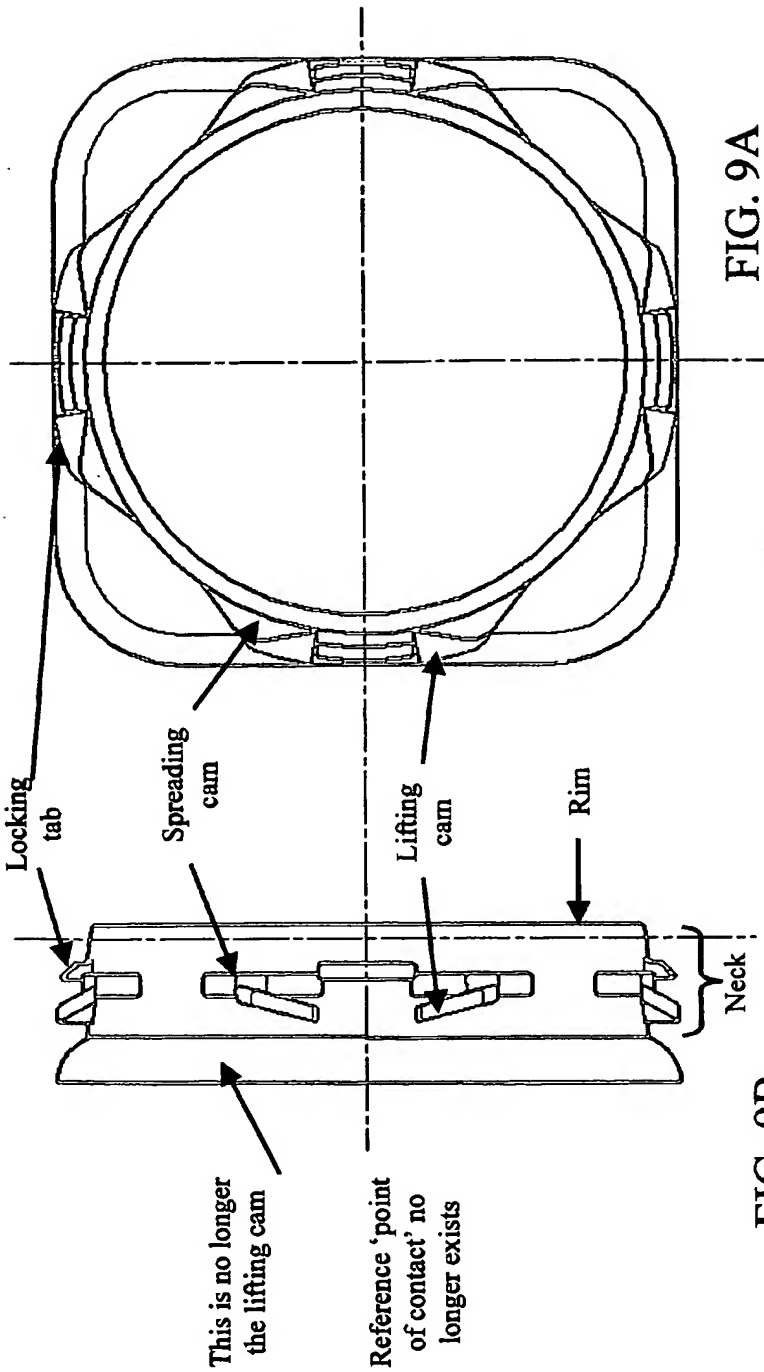


FIG. 9A

FIG. 9B

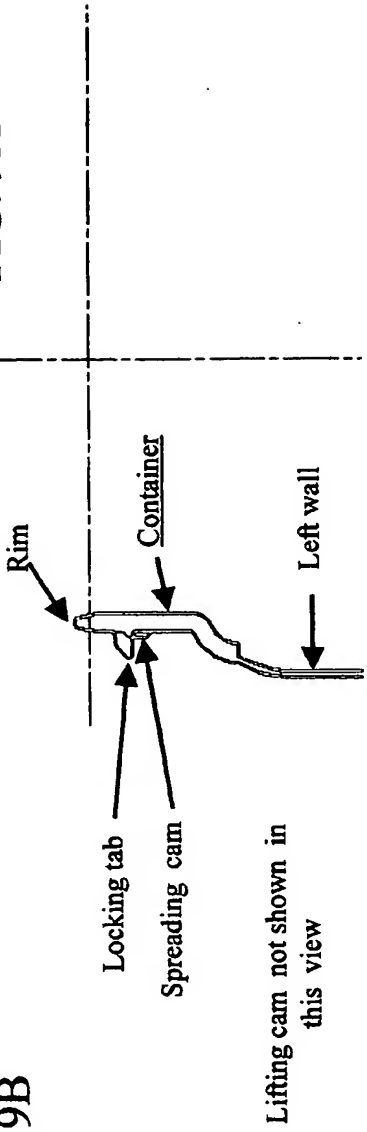


FIG. 9C

FIG. 10A

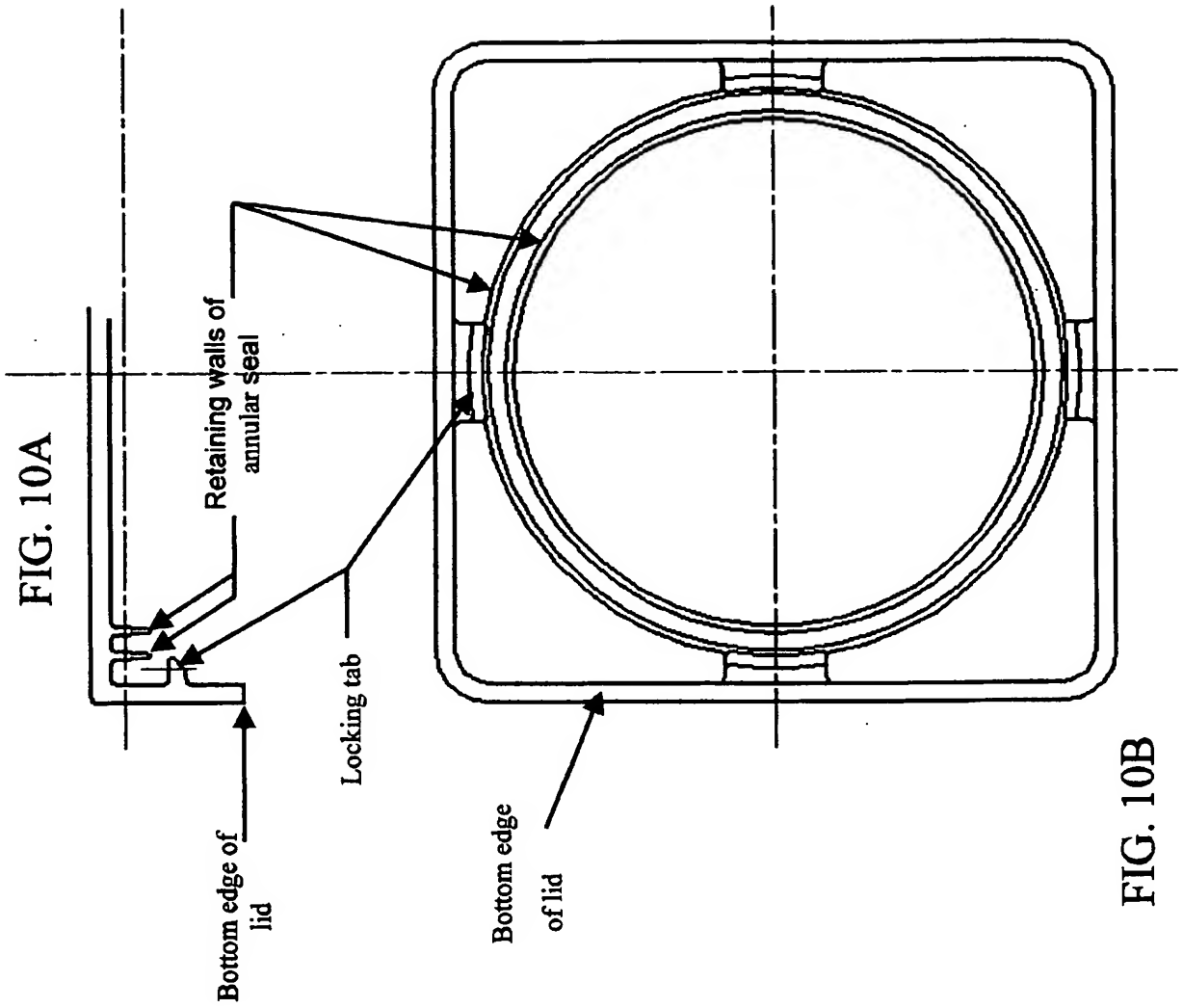


FIG. 10B

FIG. 11B

FIG. 11A

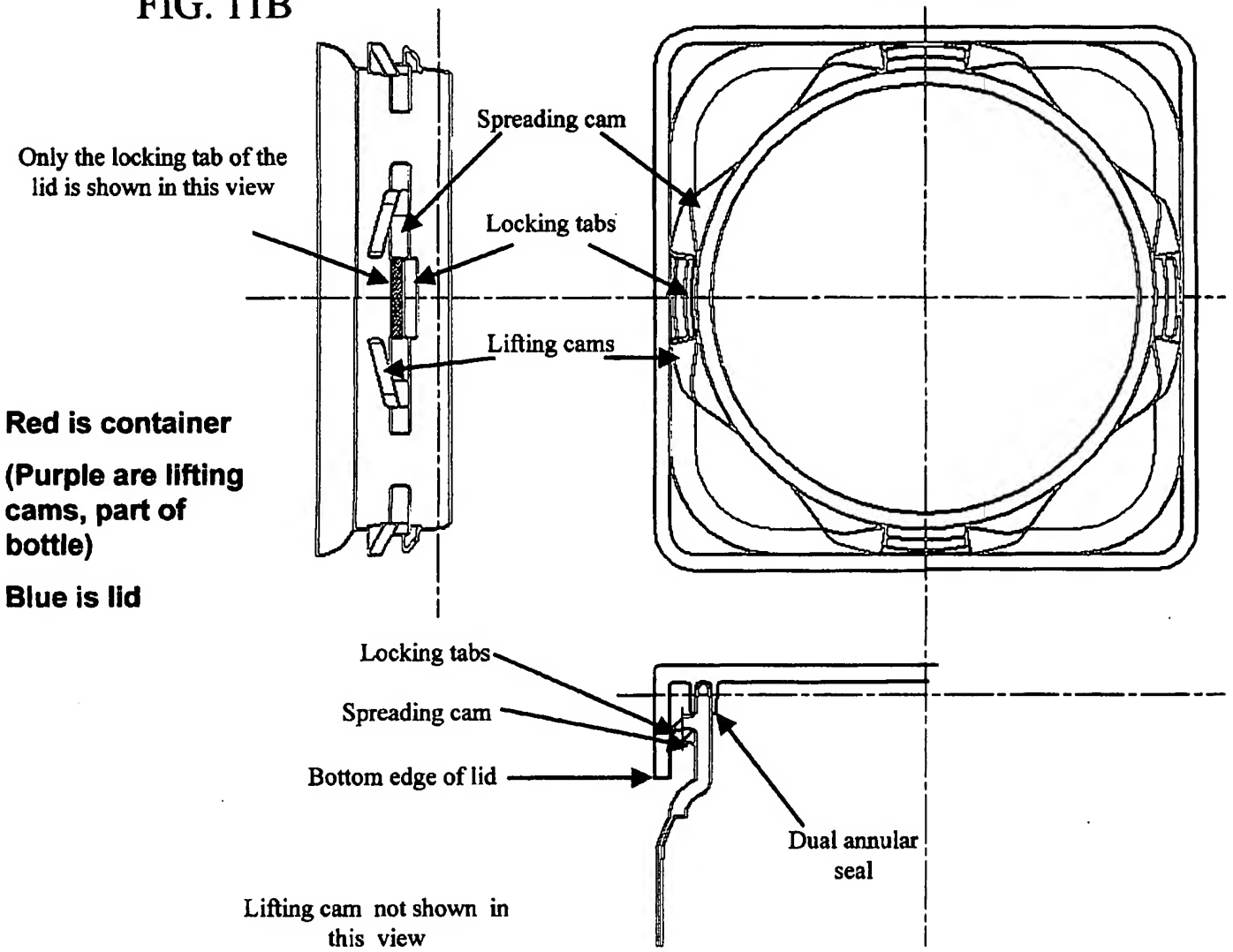


FIG. 11C

Containers (with lifting cams) and lid relationships

5 DEGREE ROTATION

5 DEGREES OF ROTATION:

1. Lid Locking tab comes into contact with container Spreading cam.
2. Lid is still firmly secured with container.

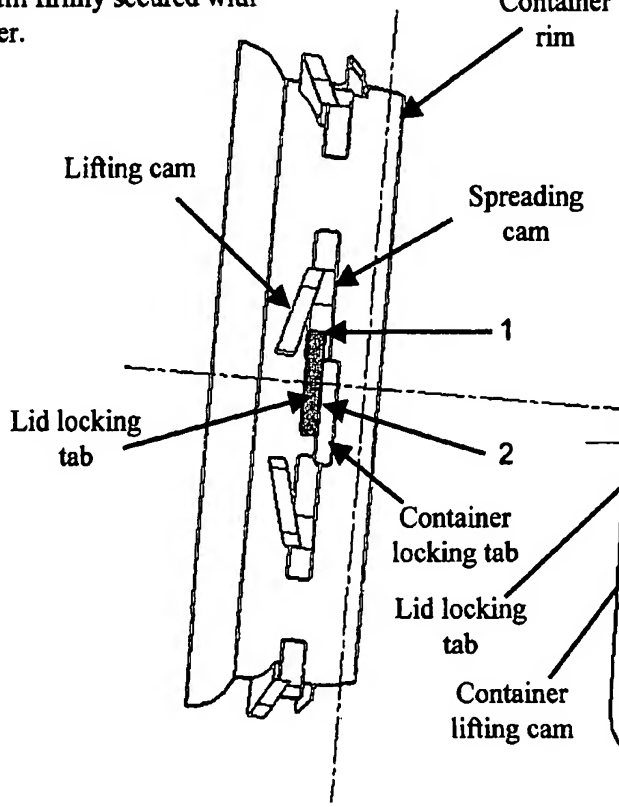


FIG. 12B

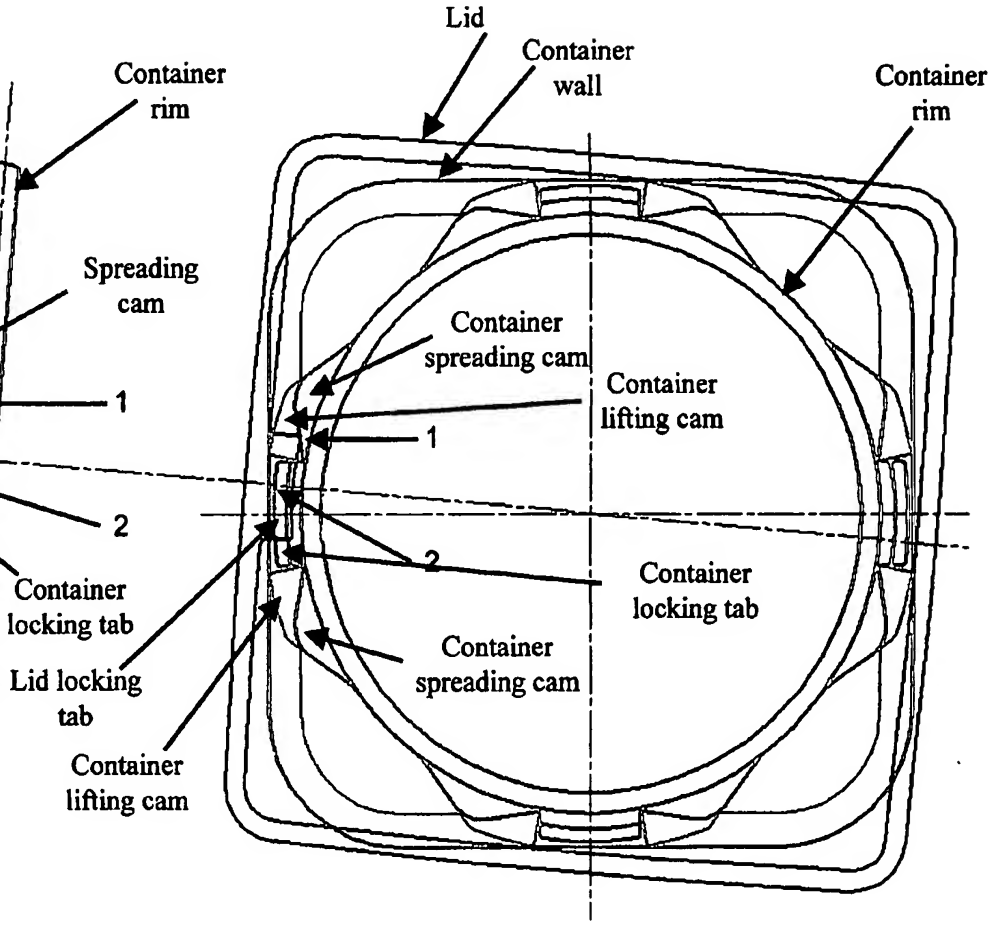


FIG. 12A

Containers (with lifting cams) and lid relationships

10 DEGREE ROTATION

10 DEGREES OF ROTATION:

1. Lid locking tab is in full contact with container spreading cam, and lid deflection is present.
2. Corner of lid locking tab is in contact with container lifting cam. Lifting force is being applied.
3. Lid is still secured with container.

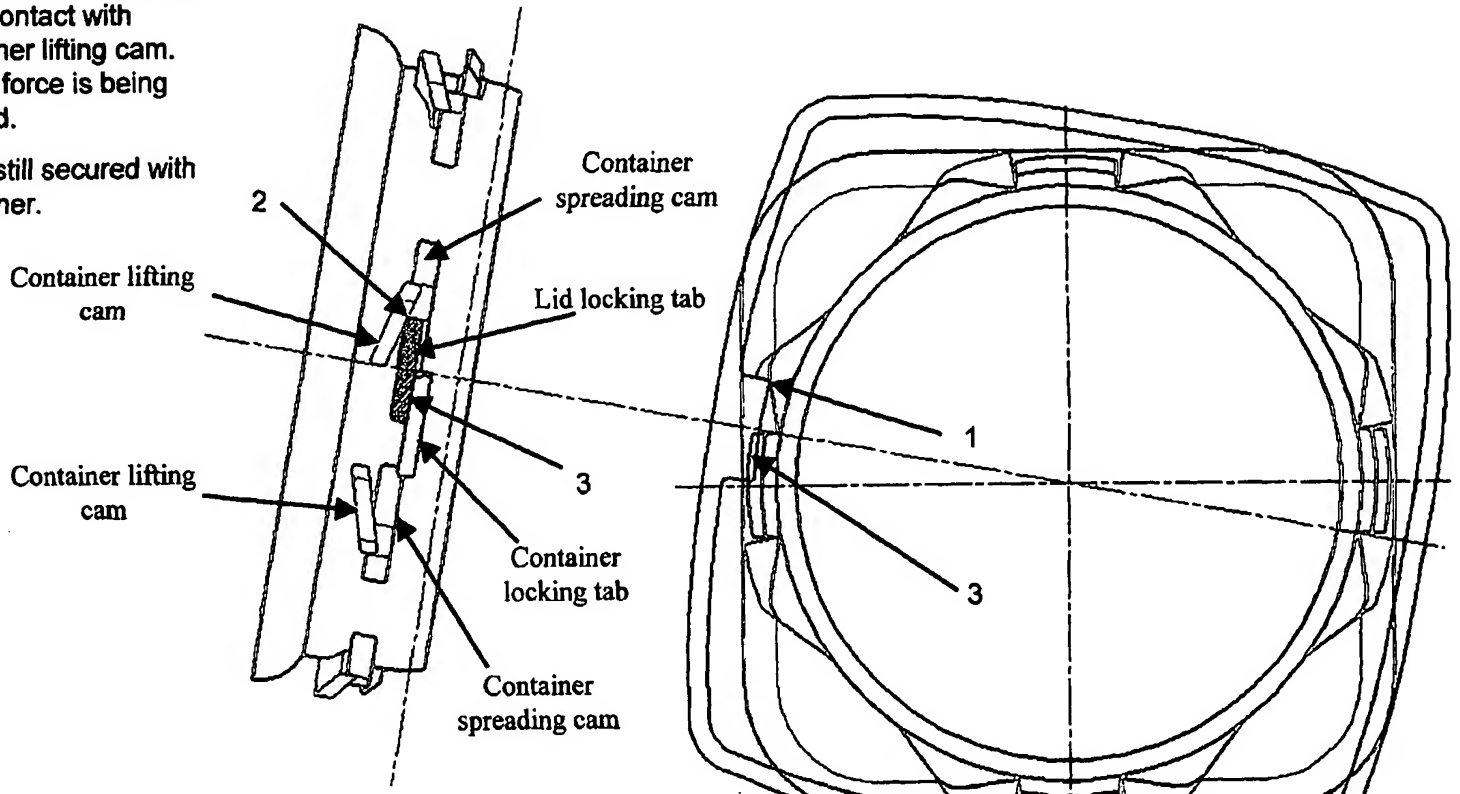


FIG. 13B

FIG. 13A

Container (with lifting cams) and lid relationships

15 DEGREE ROTATION

15 DEGREES OF ROTATION:

1. Lid locking tab reaches full spreading cam deflection and is no longer in contact with container locking tab.
2. Container lifting cam delivers upward force assisting lid locking tab off container locking tab and breaking any seal.
3. Lid is independent of the container.

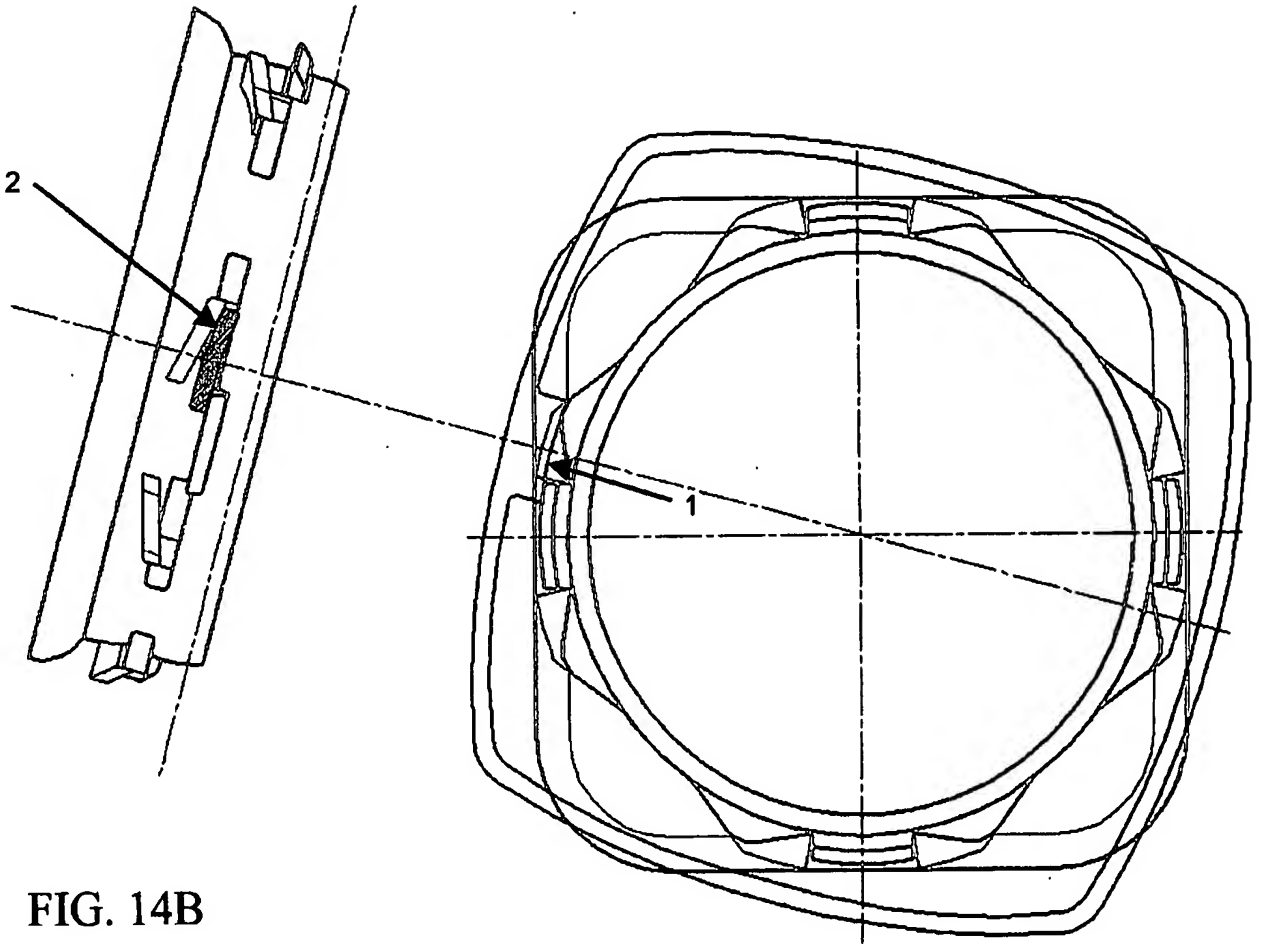


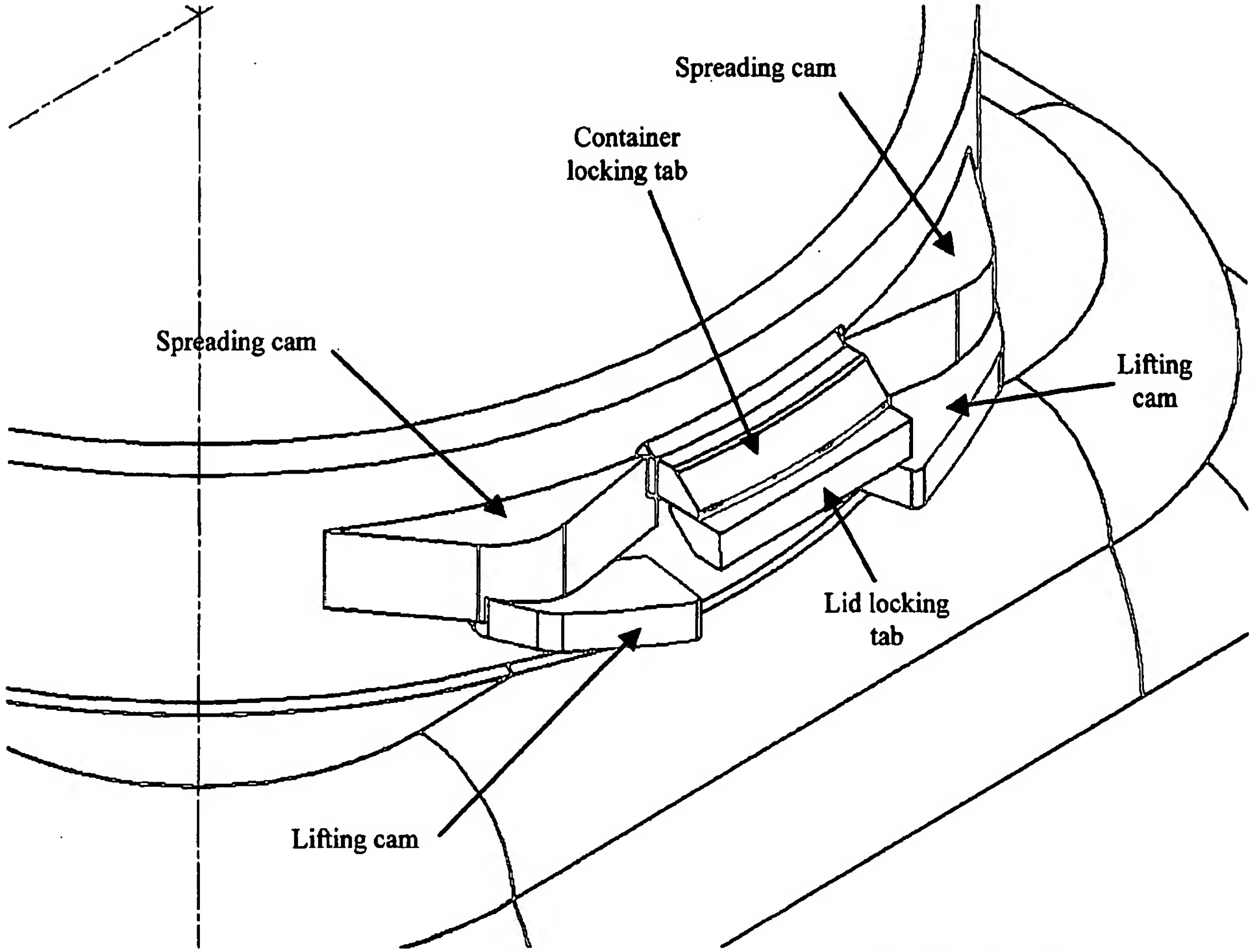
FIG. 14B

FIG. 14A

Red is container

(Purple are lifting cams, part of bottle)

Blue is lid



Container and lid
assembly with
container lifting cams.

FIG. 15

Containers (with lifting cams) and lid relationships

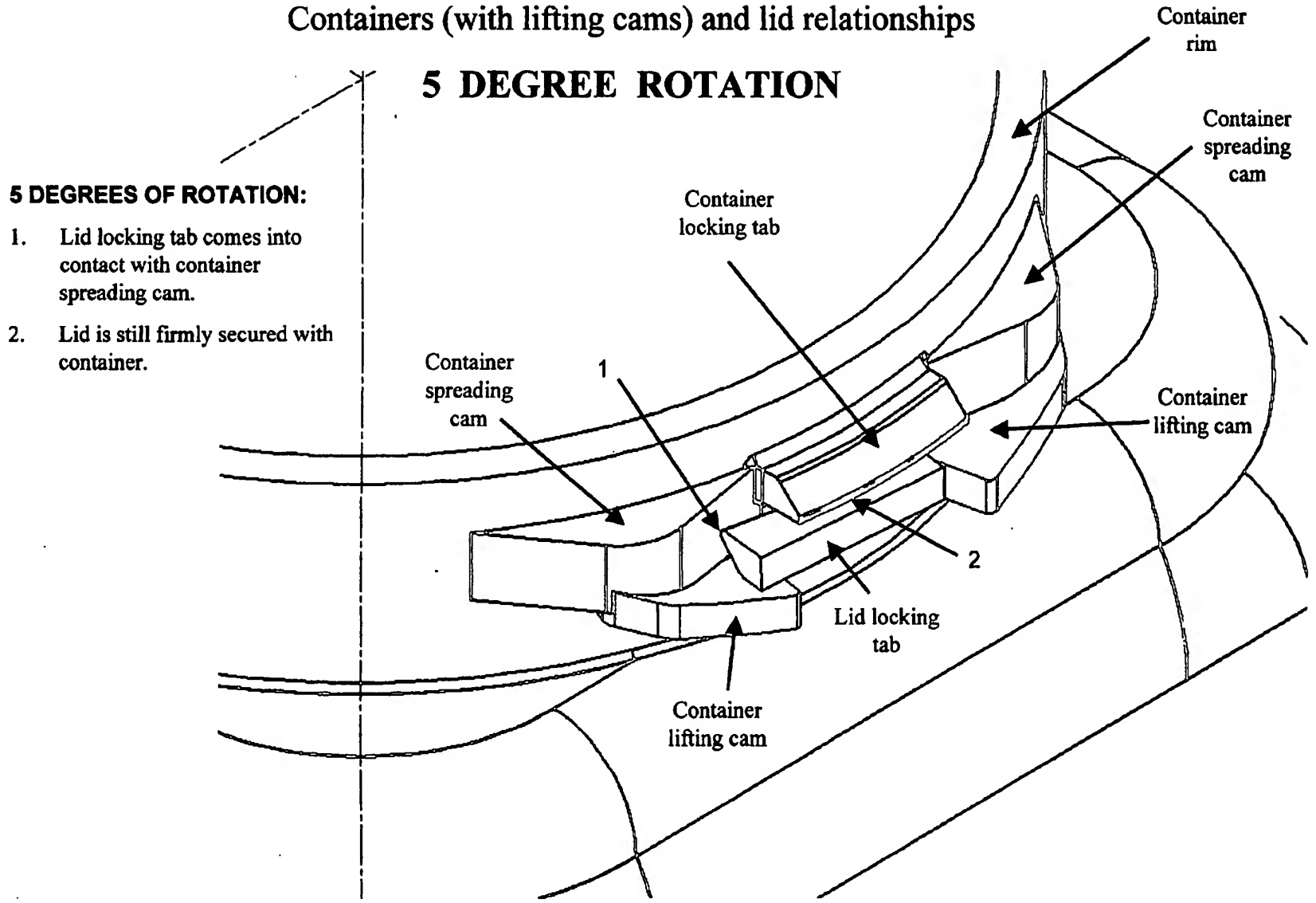


FIG. 16

Containers (with lifting cams) and lid relationships

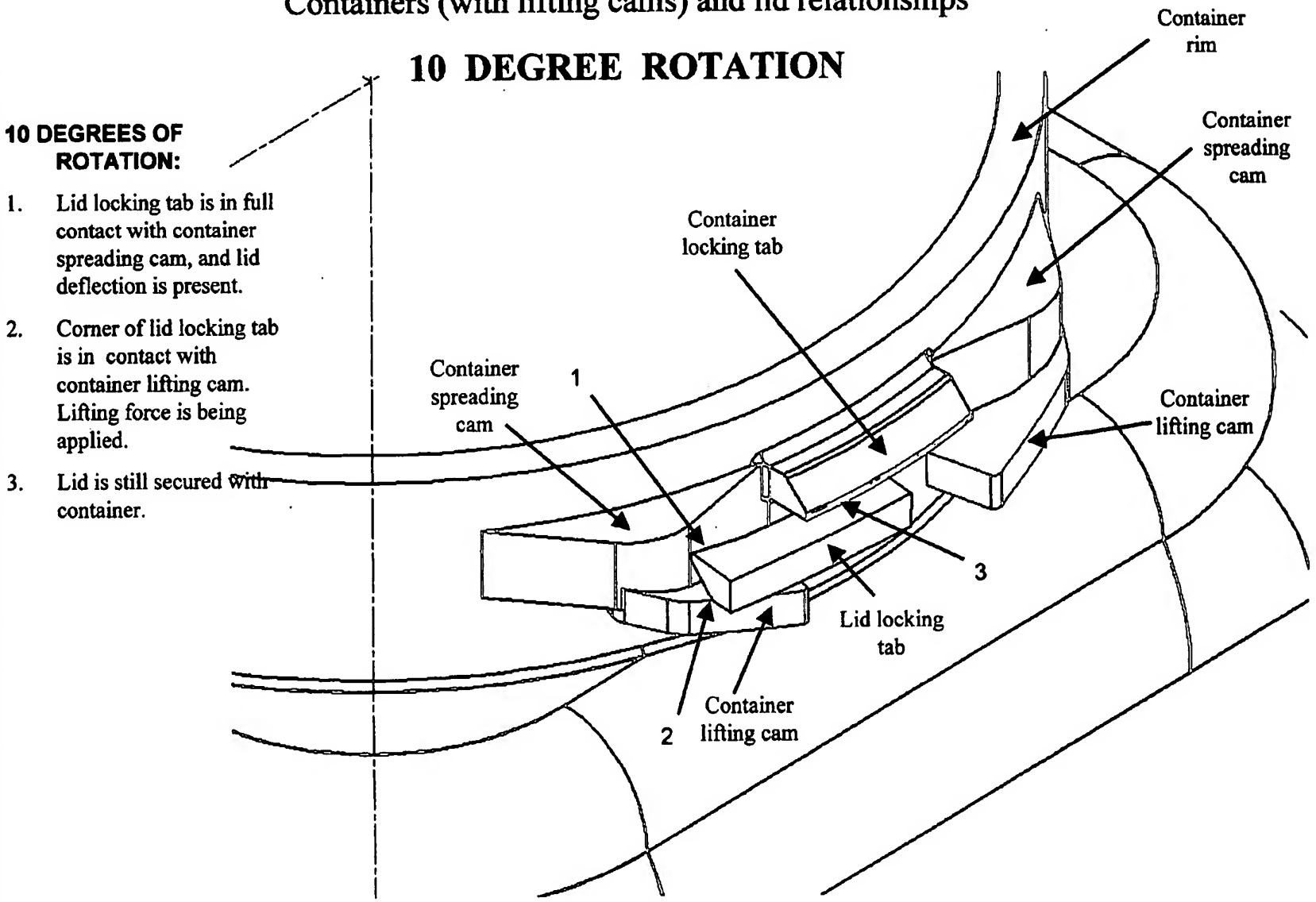


FIG. 17

Container (with lifting cams) and lid relationships

15 DEGREE ROTATION

15 DEGREES OF ROTATION:

1. Lid locking tab reaches full spreading cam deflection and is no longer in contact with container locking tab.
2. Container lifting cam delivers upward force assisting lid locking tab off container locking tab and breaking any seal.
3. Spreading and lifting forces will overcome any remaining locking force. Lid is independent of the container.

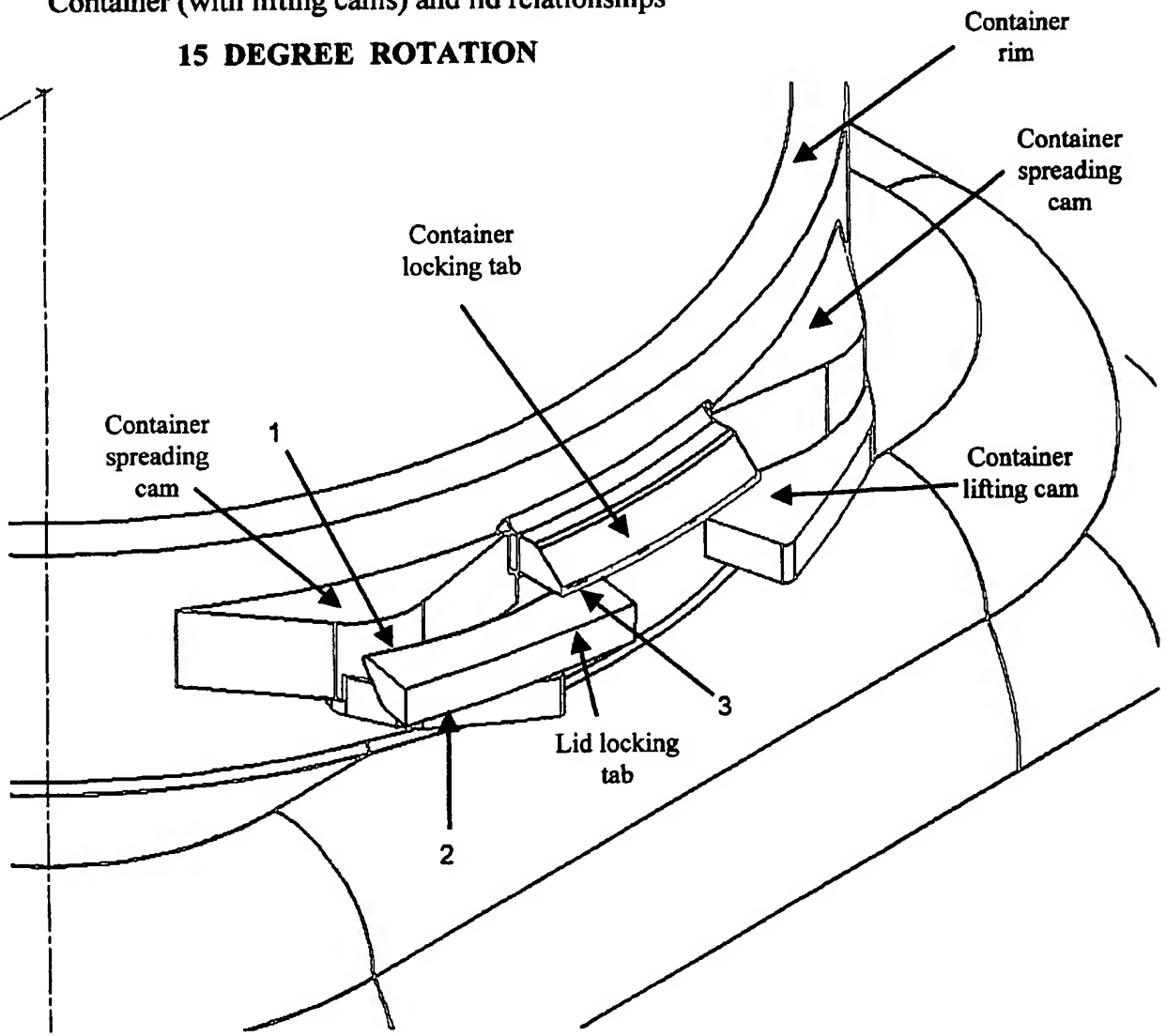
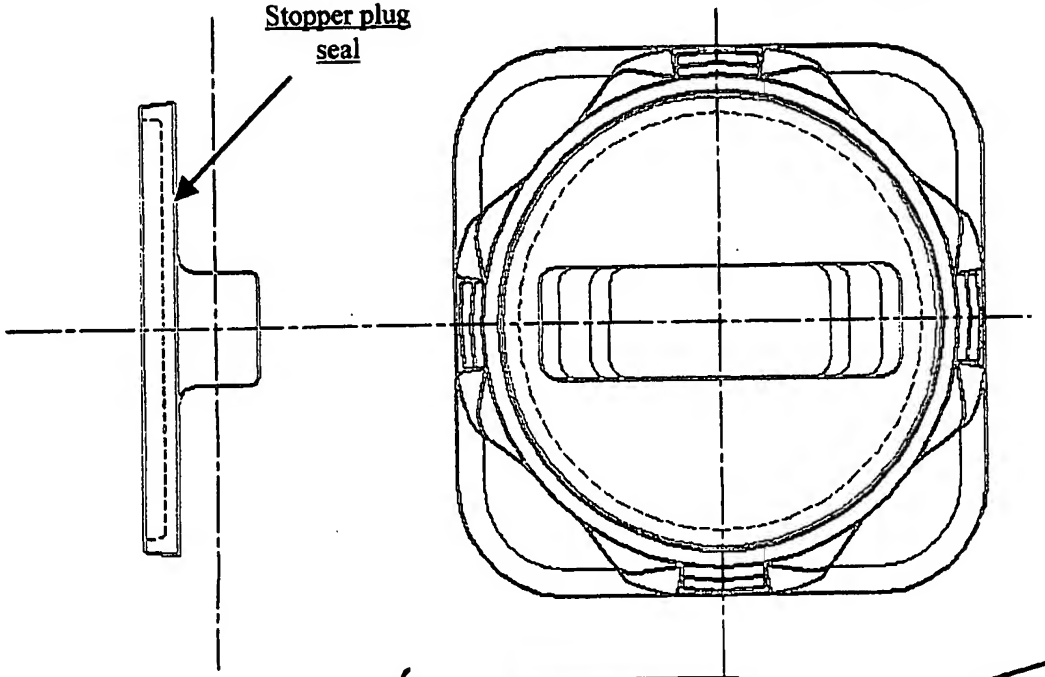


FIG. 18

FIG. 19A



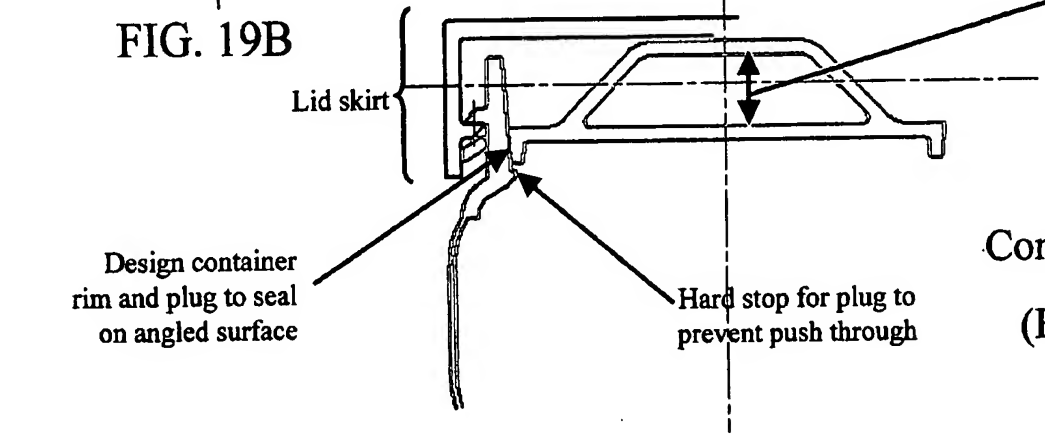
Red is container

(Purple are lifting cams, part of container)

Yellow is seal

Blue is lid

FIG. 19B



- Plug design must allow slide pull in the mold
- ¼" Gap in plug handle for spoon end
- Overall container and lid height increase 1/8"

FIG. 19C

Container with Stopper plug seal

(Hard rigid material assumed)

FIG. 20A

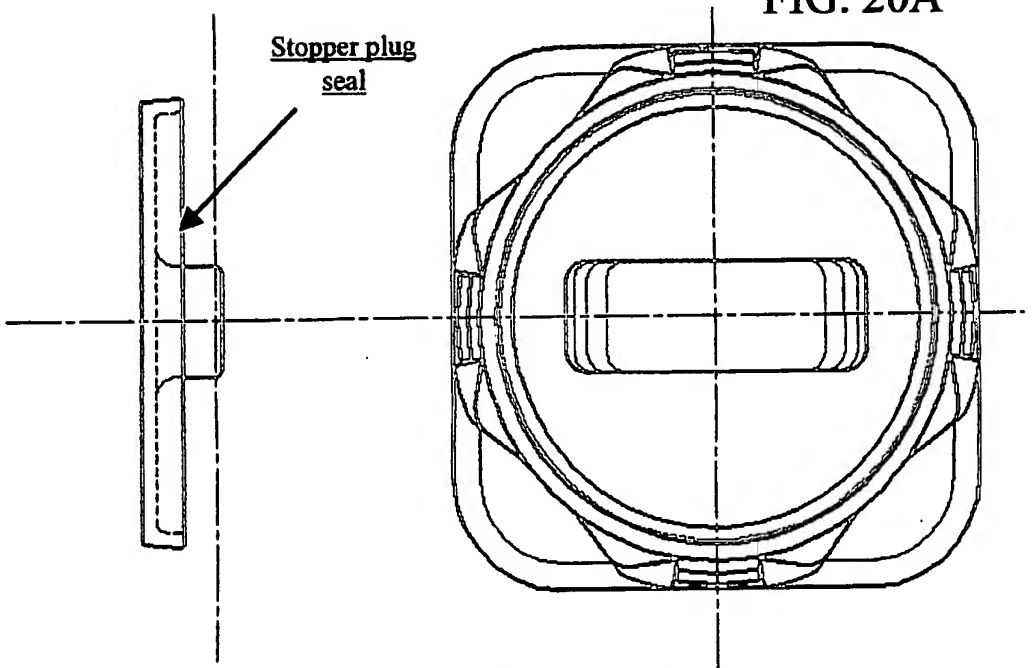
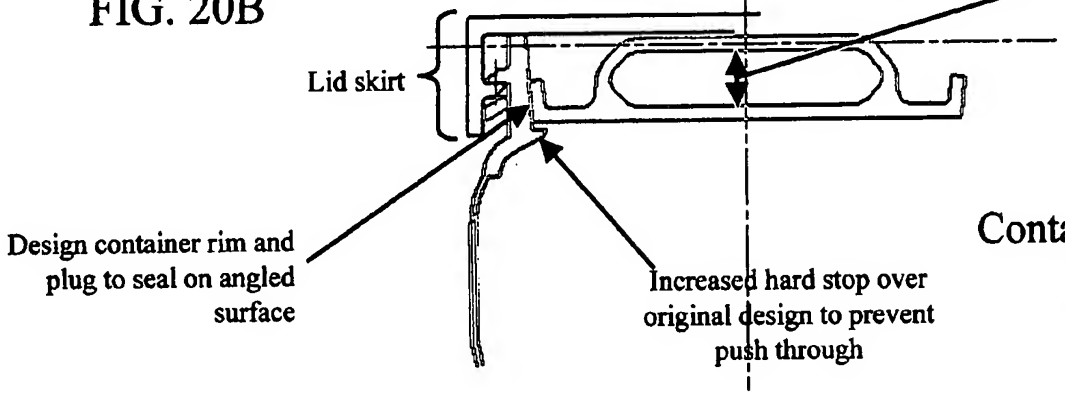


FIG. 20B



Red is container

(Purple are lifting cams, part of container)

Yellow is seal

Blue is lid

- Semi-pliable material allows some overlap of features
- 3/16" gap in plug handle for spoon end
- No increase in container and lid height

Container with stopper plug seal

(Option a – low profile)

(Semi-pliable material)

FIG. 20C

FIG. 21A

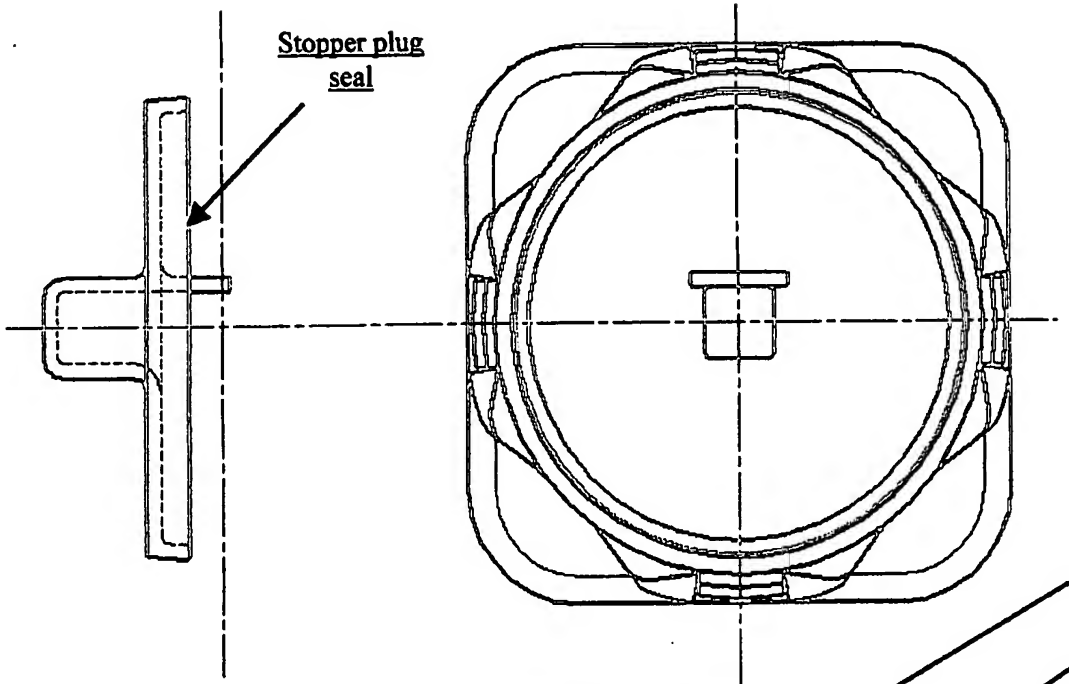
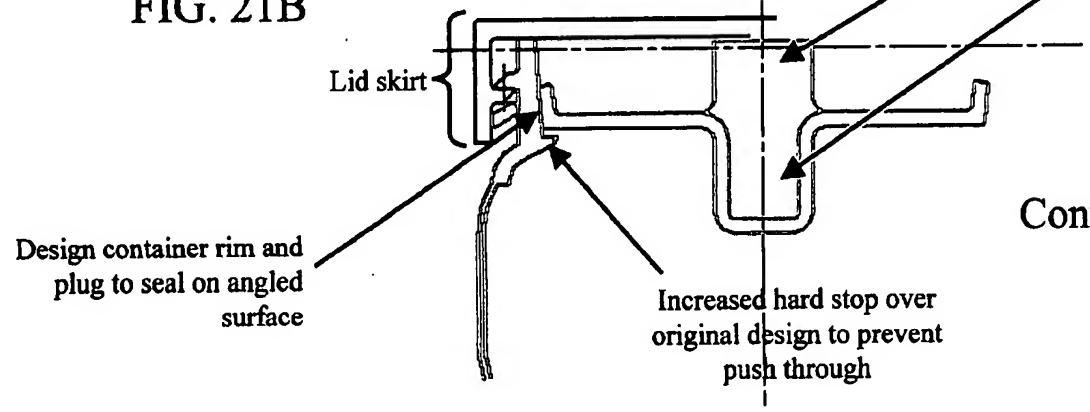


FIG. 21B



Red is container

(Purple are lifting cams, part of container)

Yellow is seal

Blue is lid

- Slides not required for this design
- ¼" By 3/8" raised tab for thumb
- ¼" Square by 3/8" deep pocket for spoon end
- Consumer inserts spoon end into slot and pinches the tab between spoon and thumb, then pries off seal

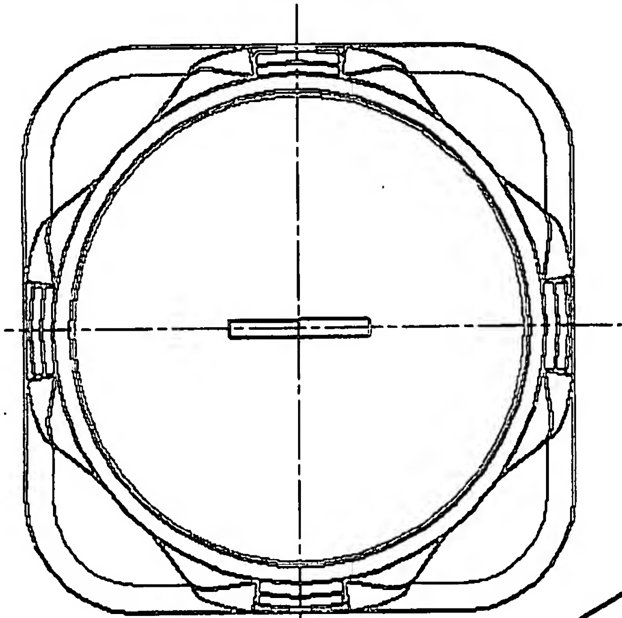
Container with stopper plug seal

(Option b – slot and tab)

(Semi-pliable material)

FIG. 21C

FIG. 22A



Red is container

(Purple are lifting cams, part of container)

Yellow is seal

Blue is lid

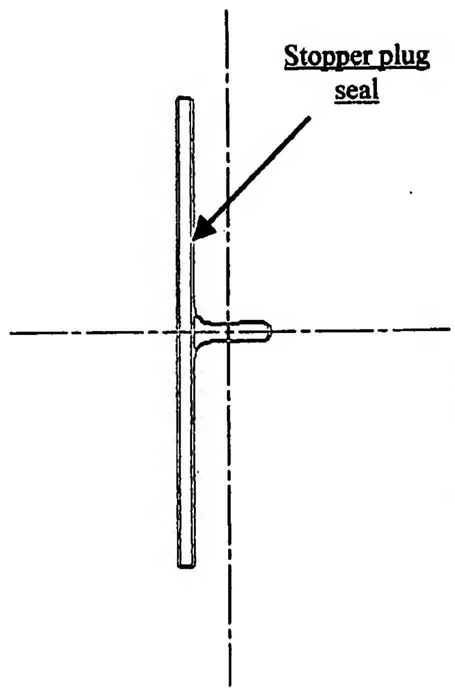
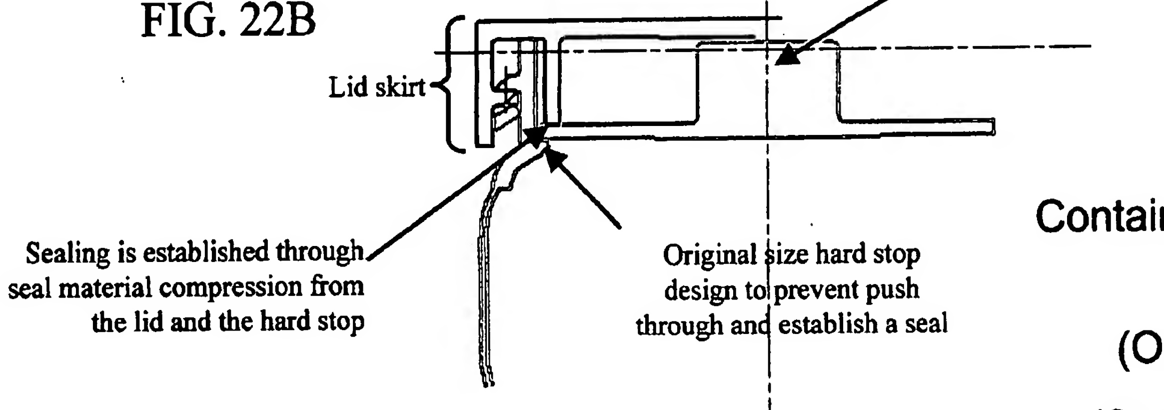


FIG. 22B



- Slides not required for this design
- ¼" By 1/2" raised tab for thumb and finger
- A loose fit seal can be easily removed

FIG. 22C

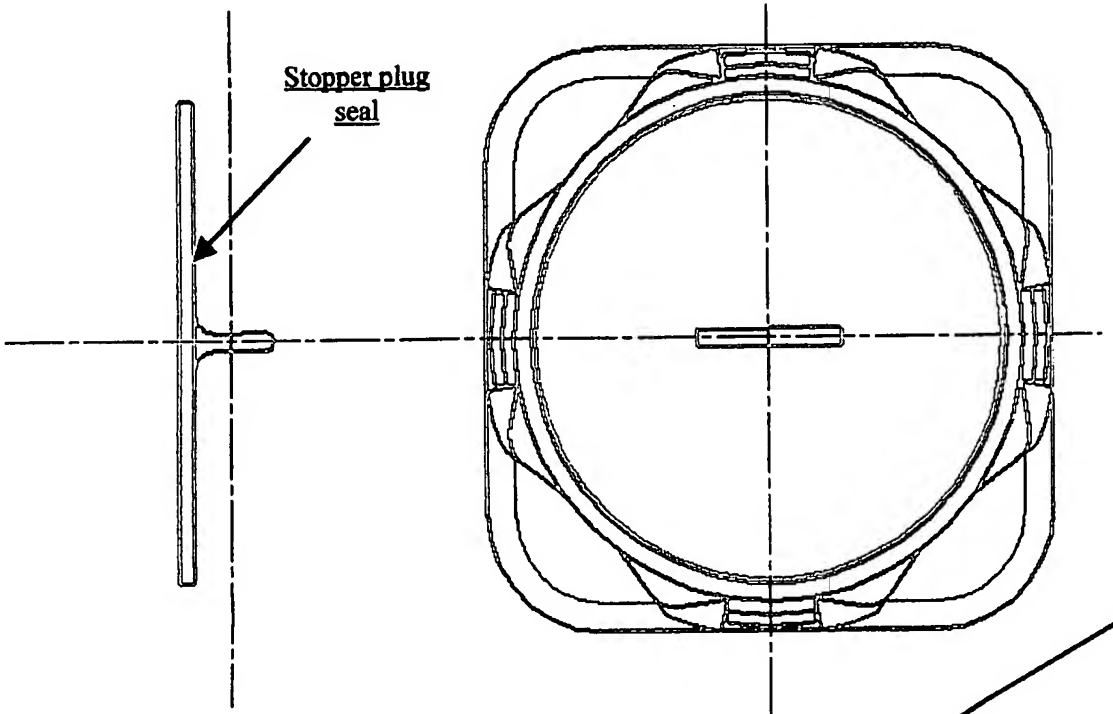
Container with stopper plug seal

(Option c – loose fit)

(Semi-pliable material)

60477759.061003

FIG. 23A



Red is container

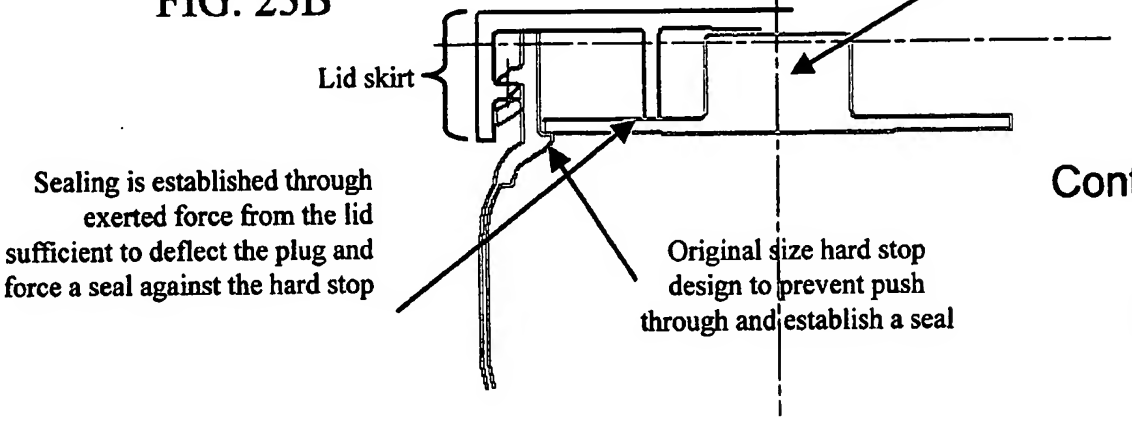
(Purple are lifting cams, part of container)

Yellow is seal

Blue is lid

- Slides not required for this design
- ¼" By 1/2" raised tab for thumb and finger
- A loose fit seal can be easily removed

FIG. 23B



Container with stopper plug seal

(Option d – loose fit)

(Hard material)

FIG. 23C

FIG. 24A

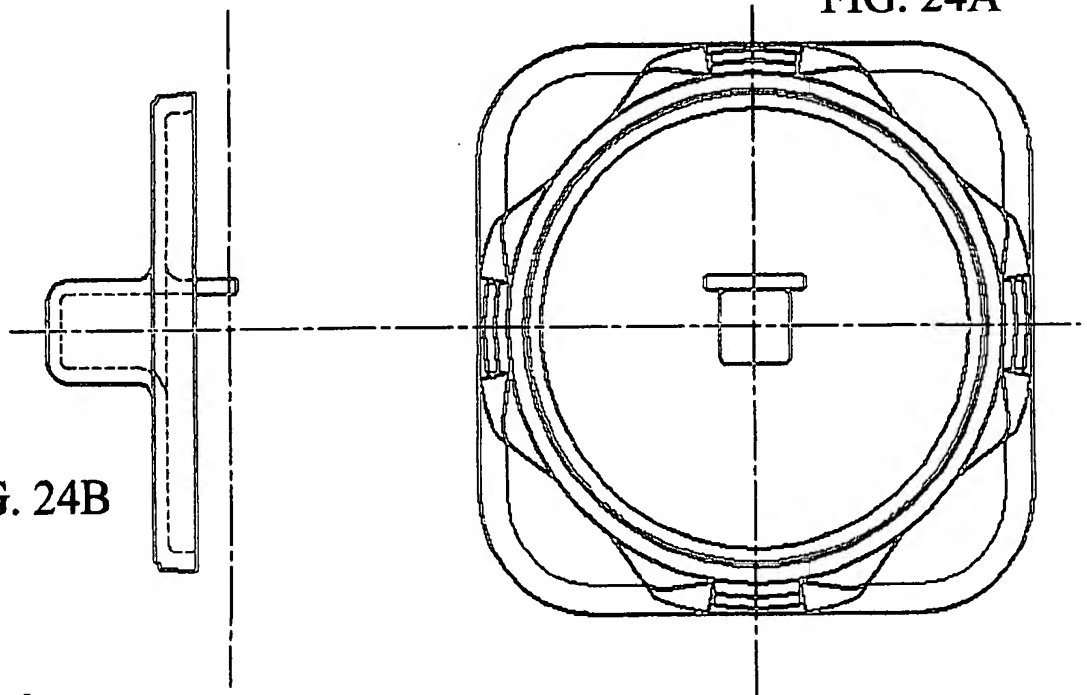


FIG. 24B

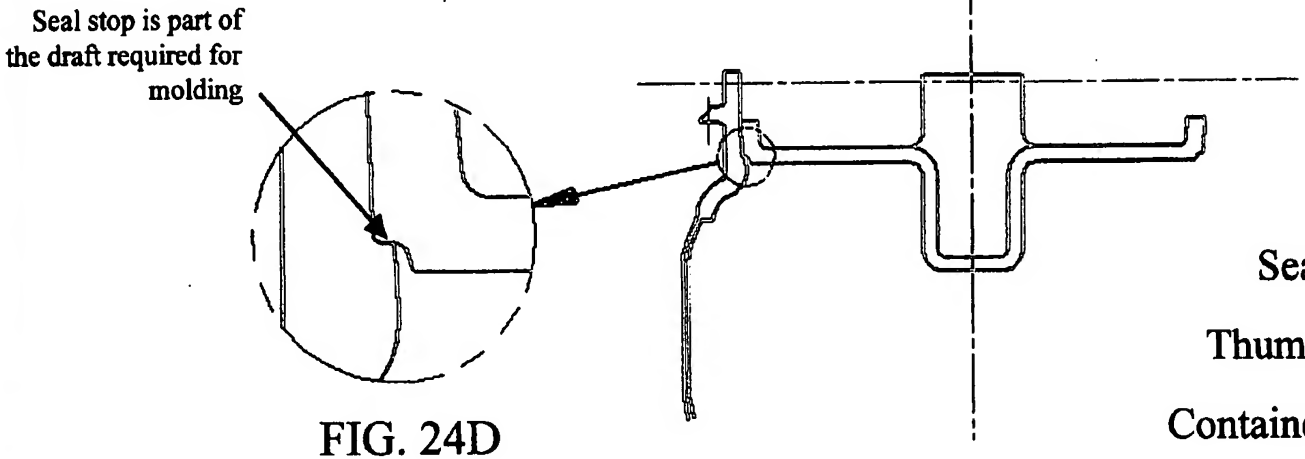


FIG. 24D

FIG. 24C

Sealing options

Thumb and tab design

Container drafted seal stop

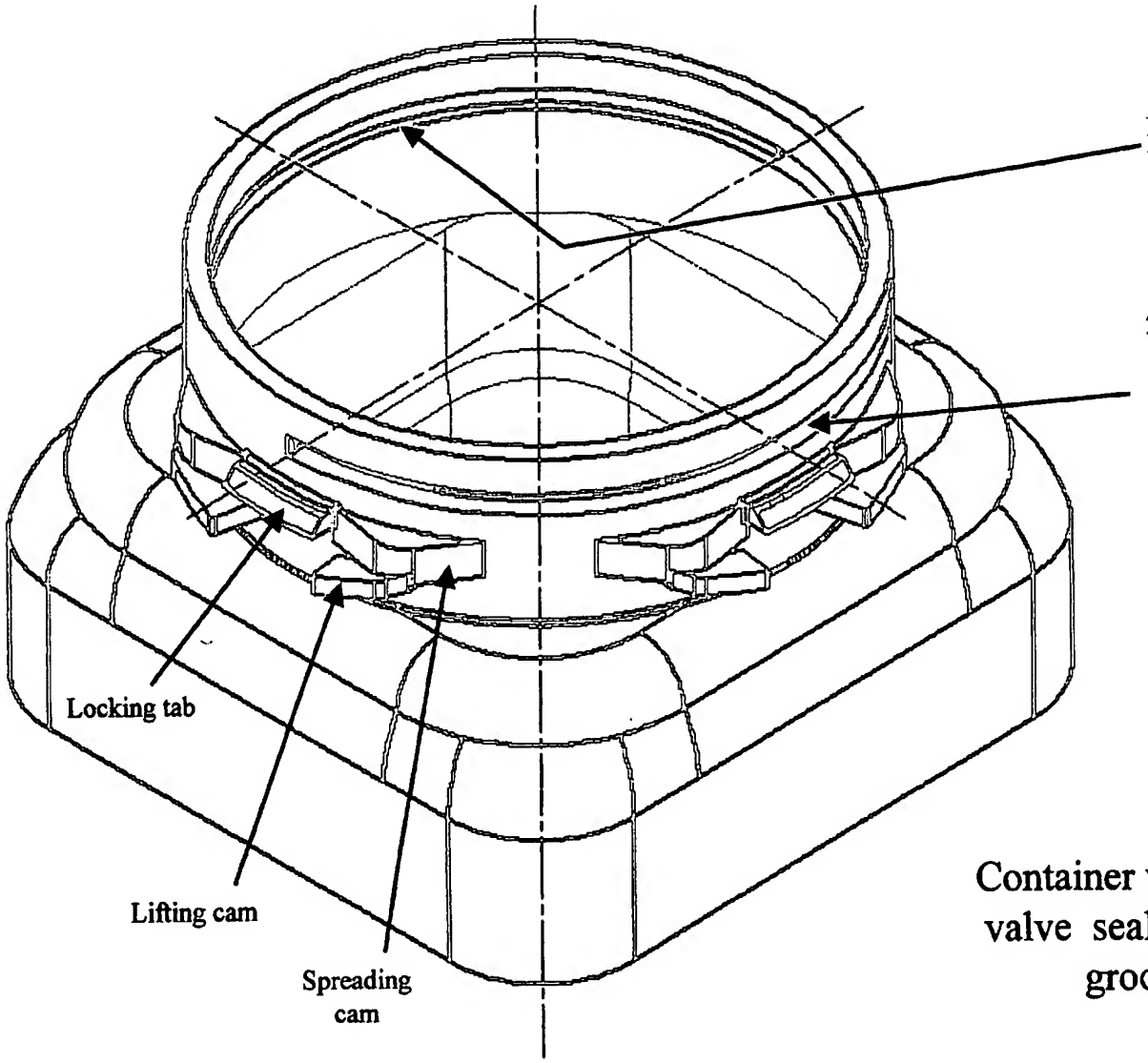
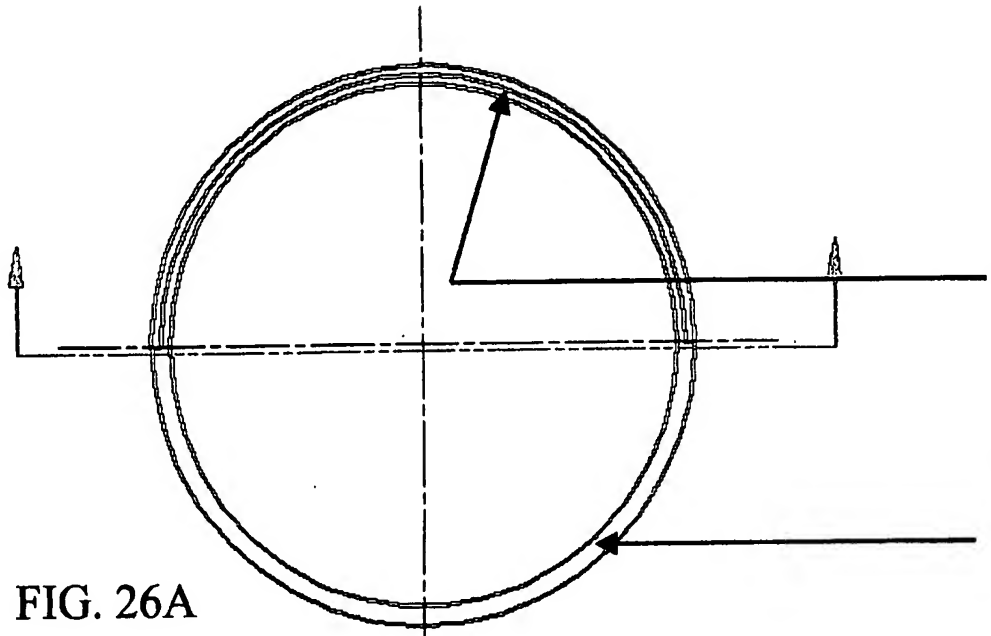
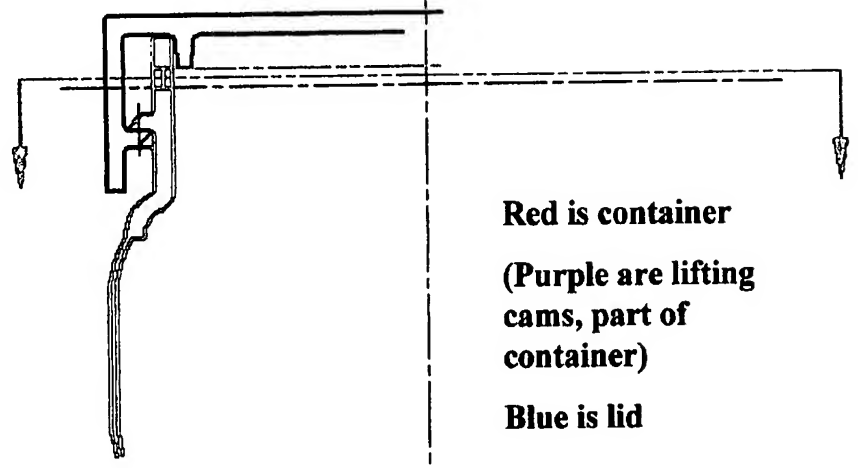


FIG. 25



1. A groove, half the thickness of the container rim, exists around ½ of the inside diameter of the rim.
2. Coplanar with the groove is an opening through the rim comprising the other half of the diameter

FIG. 26A



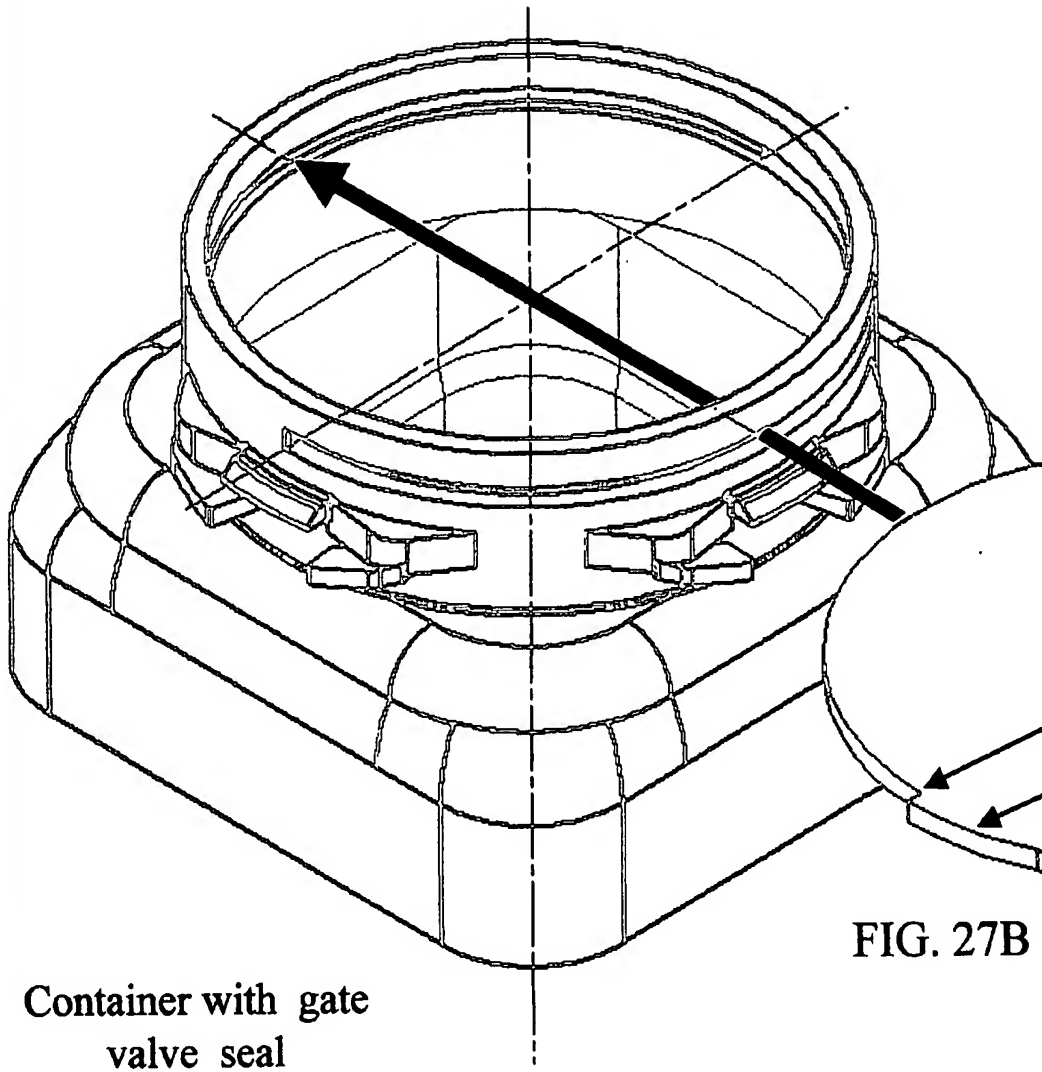
Red is container

(Purple are lifting cams, part of container)

Blue is lid

FIG. 26B

Container with gate valve seal and seal groove



Container with gate valve seal

FIG. 27A

1. Forward seal radius matched the inside container rim groove radius
2. Stopping tabs on the center axis help insure proper positioning
3. External radii are designed as not to interfere with the lid locking tabs during closure

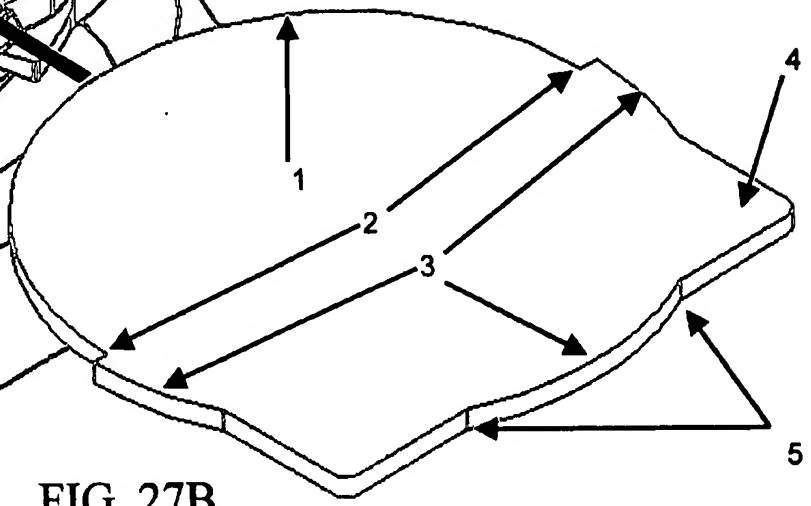


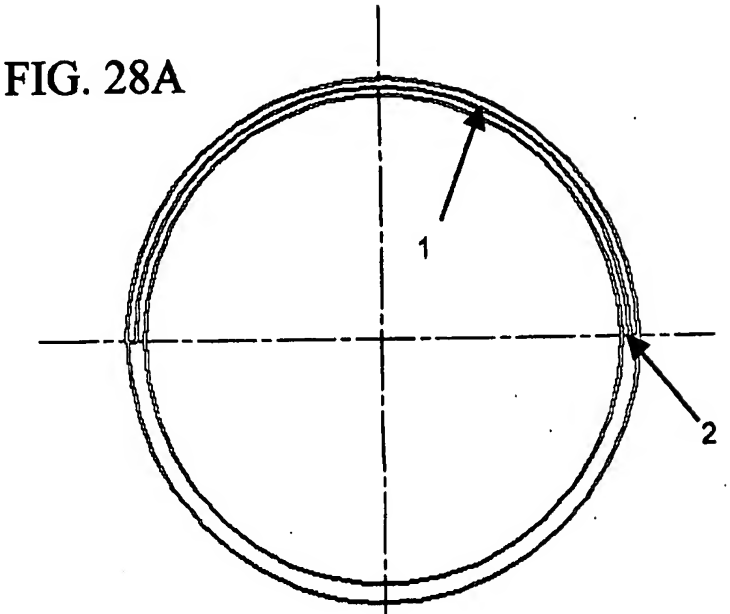
FIG. 27B

4. Corner tabs exist as handles for seal removal
5. Corner tabs start and end points are designed as not to interfere with lid locking tabs during twisting for disassembly

1. Forward seal radius matched the inside container rim groove radius
2. Stopping tabs on the center axis help insure proper positioning
3. External radii are designed as not to interfere with the lid locking tabs during closure
4. Corner tabs exist as handles for seal removal
5. Corner tabs start and end points are designed as not to interfere with lid locking tabs during twisting for disassembly

Container with gate valve seal

FIG. 28A



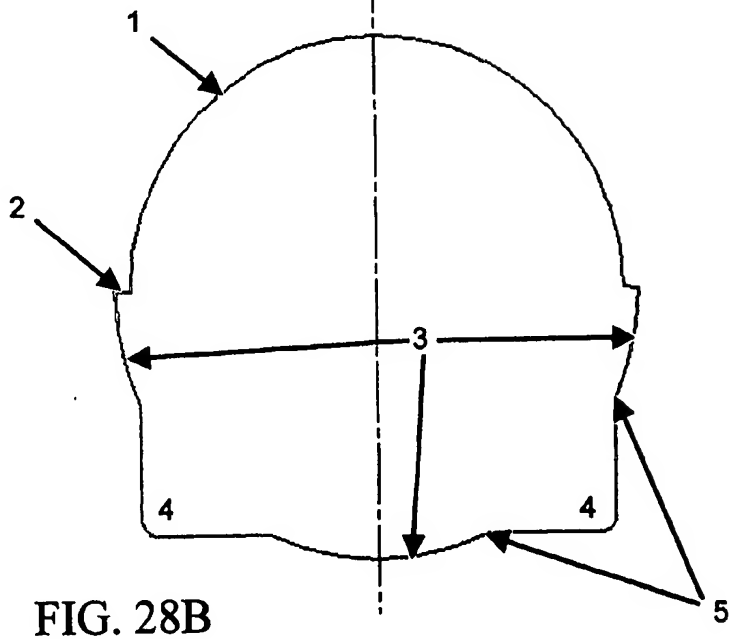
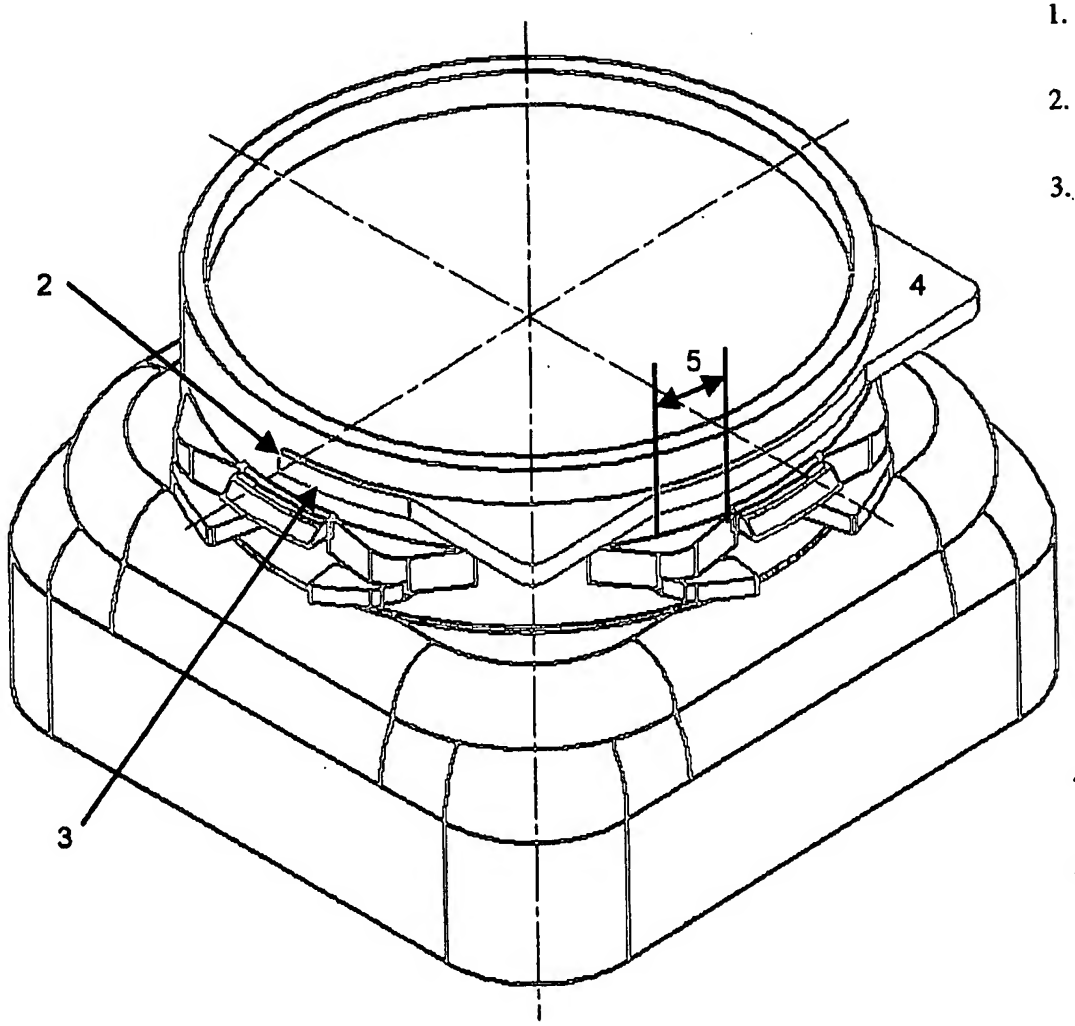


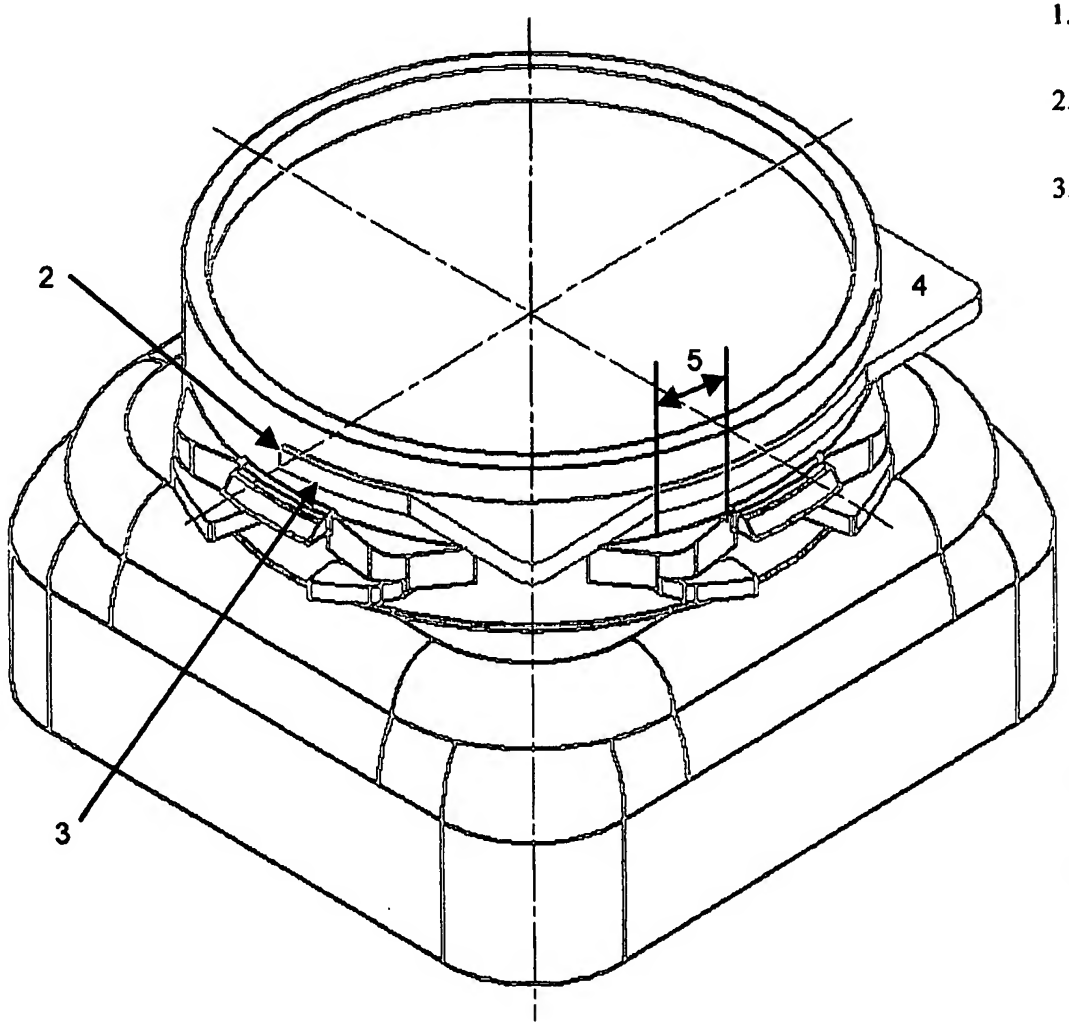
FIG. 28B



Container with gate valve seal in position

1. Forward seal radius matched the inside container rim groove radius (not visible)
2. Stopping tabs on the center axis help insure proper positioning
3. External radii are designed as not to interfere with the lid locking tabs during closure
4. Corner tabs exist as handles for seal removal
5. Corner tabs start and end points are designed as not to interfere with lid locking tabs during twisting for disassembly

FIG. 29



Container with gate valve seal in position

1. Forward seal radius matched the inside container rim groove radius (not visible)
2. Stopping tabs on the center axis help insure proper positioning
3. External radii are designed as not to interfere with the lid locking tabs during closure
4. Corner tabs exist as handles for seal removal
5. Corner tabs start and end points are designed as not to interfere with lid locking tabs during twisting for disassembly

FIG. 29

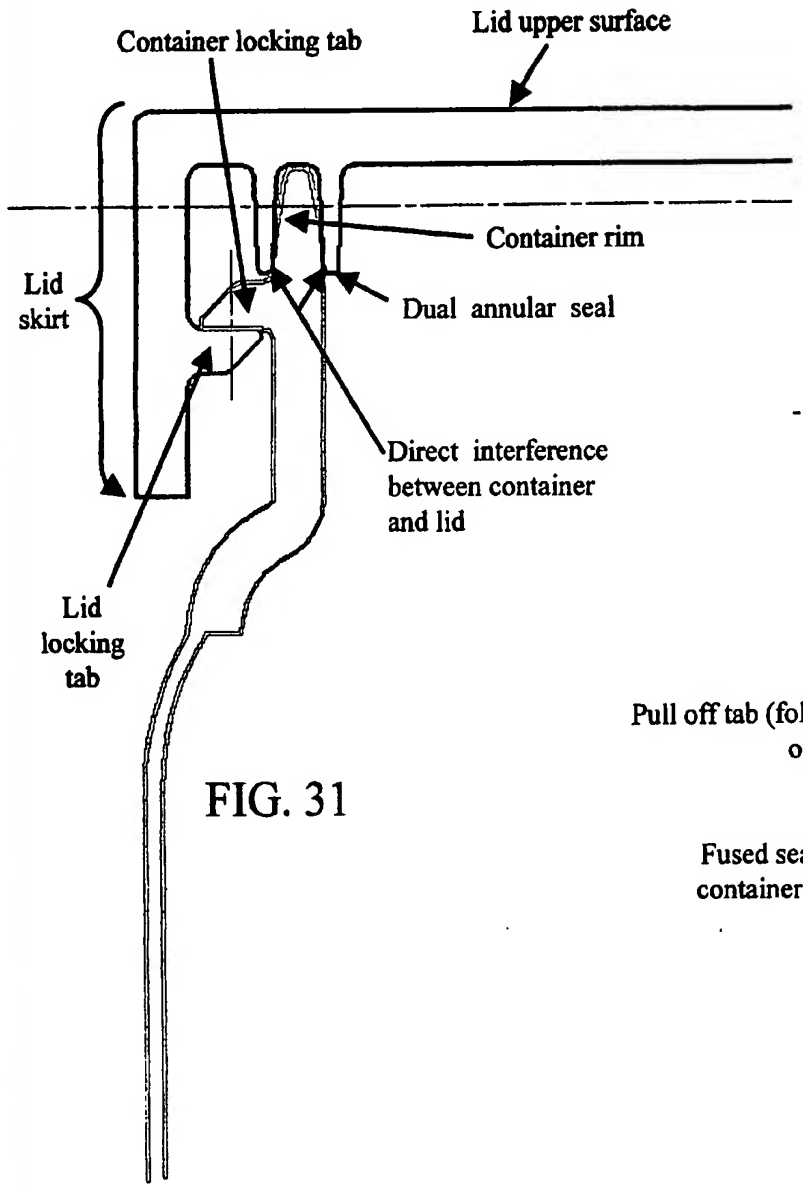


FIG. 31

Sealing Options

FIG. 32A

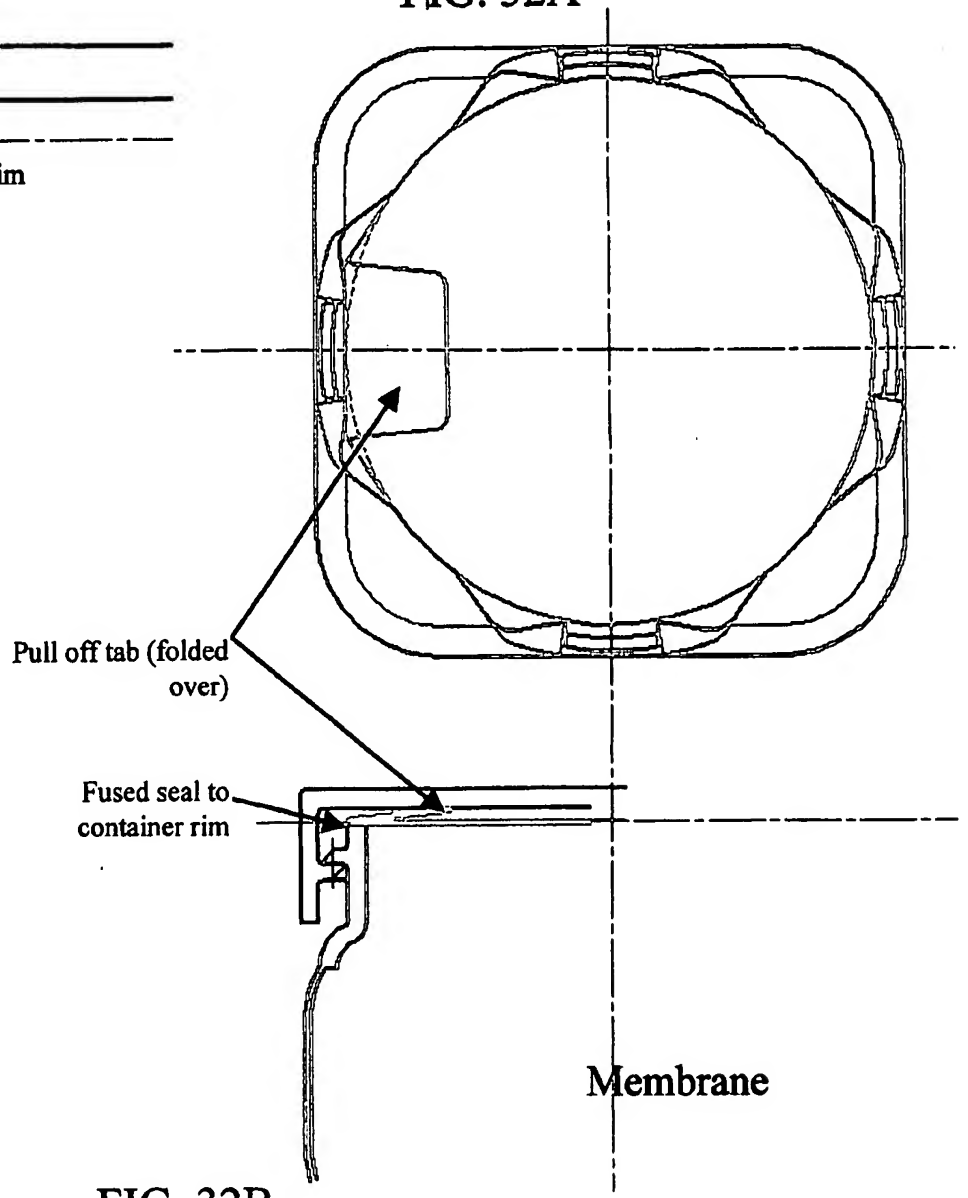


FIG. 32B

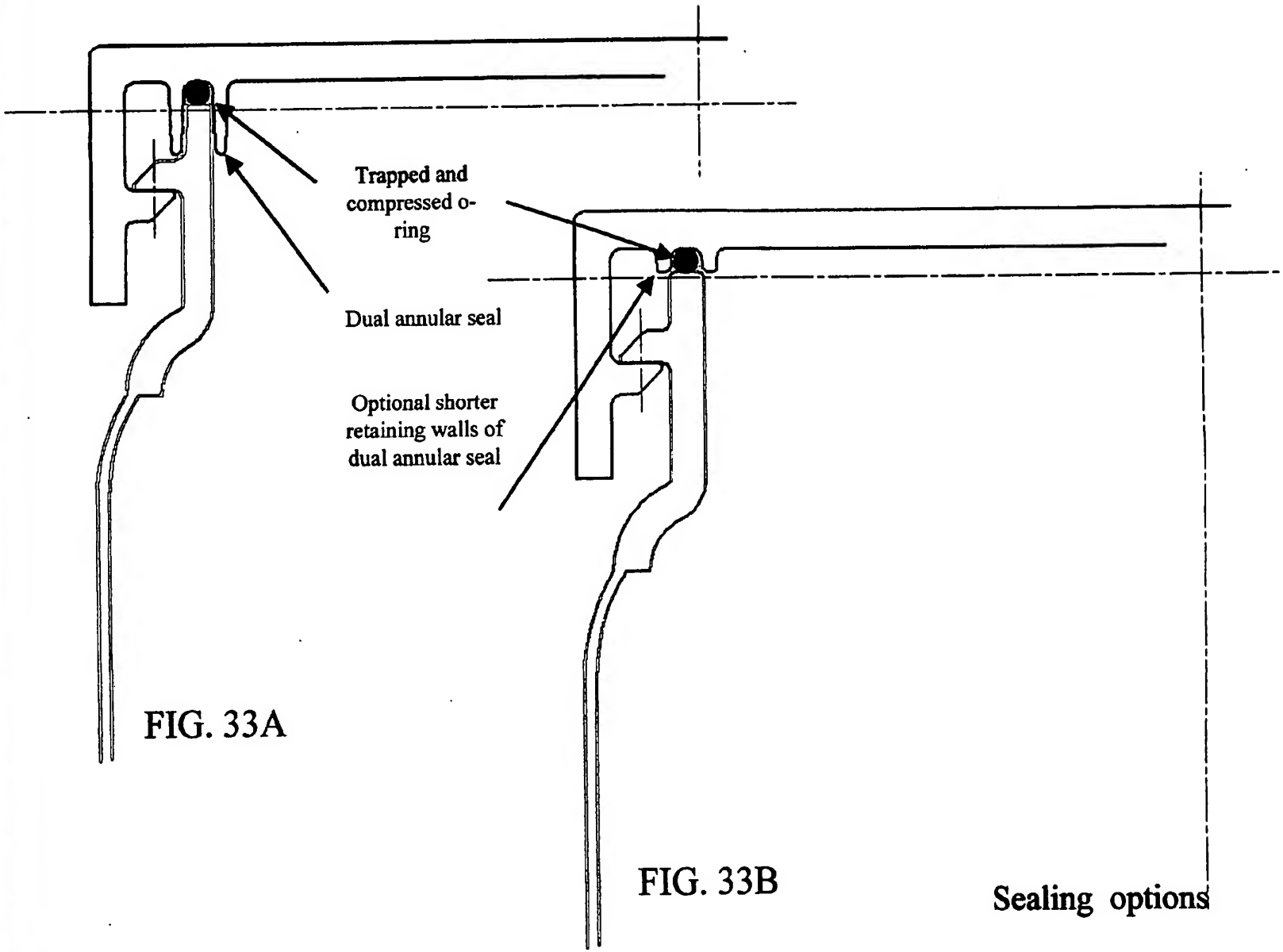


FIG. 33A

FIG. 33B

Sealing options